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EDITORIAL

CPR revisited: the current scenario in Malta

Simon Paul Attard Montalto

Back in 2016, an editorial in the MMJ presented an overview of cardiopulmonary resuscitation (CPR) in Europe, and highlighted that approximately one person suffers a cardiac arrest every 45 seconds, totalling 2-3,000 per day and 350,000 per annum[1,2]. The editorial confirmed that, in the majority of cases, cardiac arrest was fatal and <10% of victims of 'out-of-hospital' arrest survive to discharge from hospital.[3] Indeed, heart disease is the leading cause of death and tops 3.3 million per annum in developed countries,[4] with 50% of these patients suffering a sudden cardiac arrest. Most succumb at this stage but survival is often associated with significant neurological disability and an inferior quality of life compared with the pre-arrest state.[5,6] Prompt and effective CPR, especially if associated with timely defibrillation in adults, delivered within 1-2 minutes of a cardiac arrest, may improve the chances of survival 3-4 fold.[3,6] However, the 'time to intervention' is paramount and survival decreases by 10% for every minute delay in the initiation of CPR.[7,8] Conversely, prompt initiation of effective bystander CPR will more than triple survival.[9]

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COVER PICTURE

'Kappella ta' San Mattew tal-Maqluba' - *Watercolour*

Chris Camilleri works as an anaesthetist. He is married to Georganne and lives in Qormi. He paints watercolour paintings of figures, portraits, animals, battle scenes & Maltese landscapes. He likes oriental art, AI & Tolkien.

The editorial reviewed the prevailing scenario in Malta in 2016-17, reporting that: "despite 71% of cardiac arrests being witnessed by laypersons, intervention only occurred in 39% of cases, including bystander defibrillation in 9% (data, Malta Resuscitation Council, MRC)". It went on to state: "that the survival to discharge from hospital after out-of-hospital arrest in Malta was just 6% (data, MRC)". Dismal statistics, indeed! But has the situation in Malta changed in 2024?

Since 2016, through the ongoing activities of the MRC, the Red Cross and several other training/educational bodies including the Health and Safety Department, Division of Education, numerous additional individuals have completed CPR training in Malta including doctors, nurses, paramedics and students, as well as teachers, laypersons, migrants, sportspersons and even children. Very recently, the exploits of the aptly named Fibrillu who successfully performs CPR on a collapsed individual has been highlighted in a specially illustrated book produced by the MRC and presented to the Division of Education to be distributed to schoolchildren.[10] Activities related to the European Resuscitation Council's (ERC) 'World Restart a Heart Day' every October, 'Kids Save Lives'[11-15], and the ERC-UEFA (and MFA) jointly-sponsored 'Get Trained Saves Lives/Goal campaign'[16] have been huge success stories. The emphasis of all these laudable initiatives has been on training laypersons and those more likely to witness a cardiac arrest, and have ensured that several hundred individuals have been recruited onto the 'CPR trained/aware' cohort of the population. The MRC estimates that this figure now exceeds 10,000 individuals in Malta and Gozo!

The success of CPR on unfortunate sports personalties who have suffered a cardiac arrest on live TV, has galvanised interest and awareness on the importance of rapid, good CPR by bystanders. Reliance on the arrival of the emergency services when the average arrival time for an urgent ambulance is likely to exceed 10 minutes[8], will inevitably incur unacceptable delays. The ever-increasing presence and availability of automated external defibrillators (AEDs) has ensured that laypersons can 'crack on', attach and activate an AED as soon as possible. Especially for adults in cardiac arrest where 'shockable' cardiac arrhythmias account for around 25-33% of cases,[17] this intervention is probably the single most important determinant for survival. In this regard, in Malta an AED-locator mobile phone App has existed for several years but, disappointingly, remains undersubscribed with too few AEDs being registered and, therefore, made available for use in the event of an arrest. The installation of AEDs in ALL public buildings, recreational spaces, and any venue where a significant number of individuals congregate (e.g. schools, churches, cinemas, etc., etc.), should be mandatory. Indeed any building application for such an establishment MUST be subject to the installation of an adequate number of AEDs pending approval. Likewise CPR training for staff in any large institution should also be mandatory, with designated staff members/departments trained and empowered to ensure its implementation.

Undoubtedly over the past two decades, the general awareness as well as formal training on CPR has increased substantially in Malta. Nevertheless there is still room for improvement, particularly with regard to coverage and availability of AEDs. For all those many individuals who are destined to suffer a cardiac arrest, the likelihood of survival is significantly linked to timely and effective CPR and, for them, trained individuals and easy access to an AED are absolutely paramount.

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REVIEW ARTICLE

Are our acute coronary syndrome patients achieving better glycaemic control after admission?

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Background

Diabetes mellitus (DM) is a cardinal cardiovascular risk factor. Tight glycaemic control is advocated as part of primary and secondary cardiovascular disease prevention. The aim of this study was to investigate the impact of acute coronary syndrome (ACS) admission on subsequent glycaemic control in known type I/II DM patients.

Methods

Patients were included if (a) known to have type I/type II DM prior to admission (b) admitted with ACS under the care of a cardiologist between January and December 2020 and (c) in possession of a haemoglobin A1c (HbA1c) result within 6 weeks of index admission (peri-admission) and a repeat result around 6 months thereafter (follow-up). Peri-admission and follow-up HbA1c levels were compared using Wilcoxon signed-rank test.

Results

One hundred and seventy patients [124 (72.9%) male; mean age 67.88 ± 10.18 years] were included. During index admission, a change in DM treatment was performed in 80 (47.1%) patients, while a diabetology review was requested for 37 (21.8%) patients. A significant reduction in HbA1c levels was demonstrated following an ACS admission with a peri-admission median level of 7.5% (IQR 2.3%) to a follow-up median of 7.1% (IQR 1.7%) (Z statistic -4.145, $p<0.001$), although at 6 months 119/170 (70%) patients still had an HbA1c above the 6.5% target.

Conclusion

Changes in DM treatment and/or advice during ACS admission appear to have an initial beneficial impact on glycaemic control in known diabetics. Aggressive long-term control is necessary to ensure more effective risk reduction.

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Diabetes mellitus (DM) is a cardinal risk factor for atherosclerotic cardiovascular disease (ASCVD). It has been associated with a two-fold excess risk of coronary artery disease, ischaemic stroke and vascular deaths, which is independent of other risk factors.[1] DM diagnosis is based on a haemoglobin A1c (HbA1c) of ≥6.5% (48 mmol/mol) or a fasting plasma glucose (FPG) of ≥7.0 mmol/L (126 mg/dl) on one occasion if there are classic symptoms of DM or on two occasion if asymptomatic, while an oral glucose tolerance test (OGTT) is recommended if there is doubt about diagnosis.[2-4] Adequate glycaemic control is a well-recognised key factor in primary and secondary prevention of coronary artery disease (CAD).[5,6] One could postulate that events that alert patients with DM to the presence of end-organ damage, like sustaining an acute coronary syndrome (ACS), could represent an eye-opener and act as a stimulus for better glycaemic control. The aim of this study was to investigate the impact of a hospital admission to Mater Dei Hospital for ACS management on glycaemic control in the early post-admission period among patients with known DM.

MATERIALS AND METHODS

Patients were eligible for inclusion if (a) admitted with an ACS under the care of a cardiologist at Mater Dei Hospital between 1st January and 31st December 2020 (b) known to have type I/type II DM prior to admission and (c) in possession of a HbA1c result within 6 weeks of index admission (peri-admission HbA1c) and a repeat result around 6 months thereafter (follow-up HbA1c). Patients who were first diagnosed with DM during their index ACS admission and those who died during the first 6 months after the index admission were excluded. In the case of patients with more than one ACS admission during the 12-month study period, only the first admission was taken into account and subsequent admissions were disregarded.

All data was collected retrospectively using hospital-based online software systems and was supplemented by information from paper notes when necessary. Data collected included basic demographic details, presence of other cardiovascular risk factors and details of DM treatment at the time of index cardiology admission. All data was initially collected on a dedicated Microsoft® Excel® spreadsheet and was anonymised at point of collection. Following institutional data protection clearance, the study protocol was approved by the University of Malta Research Ethics Committee. ACS was defined in line with international guidelines[7,8] and included ST-segment elevation myocardial infarction (STEMI), non-ST-segment elevation myocardial infarction (NSTEMI) and non-ST-segment elevation acute coronary syndrome (NSTE-ACS).

Statistical Analysis

In a first analysis, the Wilcoxon signed-rank test was used to analyse differences between peri-admission and follow-up HbA1c levels among all 170 subjects. In a secondary analysis, the cohort was divided into 2 subgroups (patients who had received an in-patient diabetic treatment change and those that did not) and the Wilcoxon signed-rank test was thereafter re-applied to each subgroup. Statistical analyses were performed using SPSS 26 (IBM SPSS 26, IBM Corp., Armonk NY). Statistical significance was defined as $p<0.05$.

RESULTS

There was a total of 783 admissions for ACS management in 771 patients during the study period. Of these, 170 met al eligibility criteria and were included in the study (Figure 1). One hundred and twenty-four (72.9%) study subjects were male and mean age was 67.88 ± 10.18 years. Forty-one (24.1%) subjects were hypertensive, 59 (34.7%) had hyperlipidaemia, 89 (52.4%) were active or past tobacco smokers and 76 (44.7%) had a history of ischaemic heart disease. An in-patient change in diabetic treatment was performed in 80 (47.1%) subjects as follows: 34 patients had their pre-admission anti-diabetic treatment dose altered or stopped, 21 had a new agent introduced on top of their previous diabetic treatment regime (if any), 10 had their pre-admission diabetic medication/s replaced with a new agent and 15 had a change in dose of their pre-admission treatment combined with the introduction of a new agent.

A significant improvement in glycaemic control at 6-month follow-up after an ACS admission was observed in the total study cohort with a reduction in HbA1c from a median of 7.5% (IQR 2.3%) around the time of admission to 7.1% (IQR 1.7%) at 6 months (Z statistic -4.145, $p<0.001$). Subgroup analysis revealed that the improvement in glycaemic control was only significant among those patients with a treatment alteration, whereby HbA1c levels dropped from a peri-admission median of 8.05% (IQR 2.48%) to 7.25% (IQR 1.45%) at 6 months (Z statistic -4.439, $p<0.001$). The change in HbA1c levels for the 90 subjects with no inpatient treatment change was not statistically

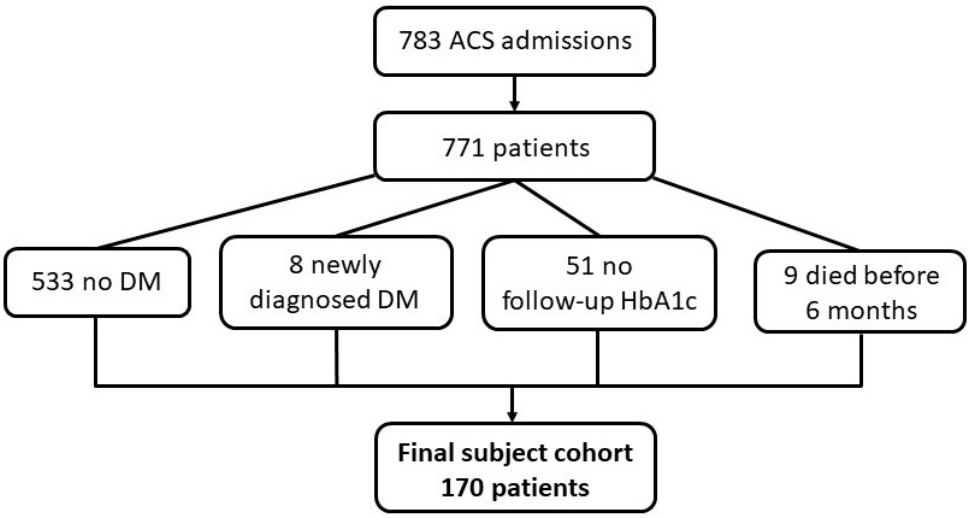

Figure 1 *Inclusion Criteria for this study*

significant (peri-admission median HbA1c = 7.1% (IQR 2.13%) vs. HbA1c at 6 months = 6.9% (IQR 1.8%); Z statistic -1.12, p=0.263).

DISCUSSION

Glycemic control is key in cardiovascular disease prevention. A ~1% reduction in HbA1c is associated with a 15% relative risk reduction in non-fatal MIs. Patients with short duration of DM, who have no ASCVD and a lower HbA1c, an intensive glucose control is more beneficial. An HbA1c target of <7% reduces microvascular complications, while evidence for an HbA1c target to reduce macrovascular risk is less compelling. However several studies have shown that long follow-up (≤20 years) is necessary to demonstrate a beneficial effect on macrovascular complications, and that early glucose control is associated with long-term cardiovascular benefits. However HbA1c targets should be individualized, with more-stringent goals (6.0–6.5%) in younger patients, if achieved without significant hypoglycemia. Less stringent HbA1c goals may be more appropriate for elderly patients with multiple comorbidities, including hypoglycemic episodes and with long-standing DM and limited life expectancy.[5,6] Patients with ASCVD and DM have an estimated 10-year risk of CVD-related death in excess of 10%.[6] Hence in this patient cohort, an improvement in glycaemic control is paramount to long-term prognosis. This should be coupled with aggressive management of any concomitant cardiovascular risk factors through more physical activity, weight loss in case of high body mass index, better blood pressure control and smoking cessation. Furthermore glucagon-like peptide 1 receptor agonists (GLP-1RAs) and sodium-glucose co-transporter 2 (SGLT2) inhibitors are now recommended to improve cardiovascular outcomes in patients with type II DM.[6]

Our results suggest that an admission with an ACS leads to a more favourable glycaemic control at 6-month follow-up. The explanation for this observation is likely to be multifactorial. Firstly an admission to hospital for specialist care of ASCVD is accompanied by a baseline risk factor assessment, meaning that patients who might have slackened in their glycaemic control assessment in the community are picked up early on. Improvement in DM medications is ensured during the hospital stay when necessary, and, as our subgroup analysis suggests, this is the main intervention to impact subsequent glycaemic control. Such improvement is further sustained by outpatient diabetologist input among those not already under active follow-up. The importance of risk factor modification is reiterated during the cardiac rehabilitation programme that the majority of patients follow after discharge. It is also likely that sustaining an acute coronary event acts as a "reality check" for many patients making them more aware of the importance of taking charge of their health to avoid further complications in the future.

Limitations

The retrospective nature of our data collection meant that an important number of subjects did not have a follow-up HbA1C at 6 months and had to be excluded from the study cohort. The number of admissions is also likely to be lower than usual given that the study period incorporated the initial months of the COVID-19 pandemic in Malta during which avoidance of the hospital environment has been well-documented.[9]

One could also measure weight at admission with ACS and 6 months after to assess the impact of weight loss and diet on HbA1c but was not possible in this study as such measurements were not taken.

ACKNOWLEDGEMENTS

We would like to thank all the people who in some way or another helped us to collect the data for this study.

CONCLUSIONS

A combination of factors related to the period around and early after an admission with ACS, particularly in the form of introduction or revision of DM medications, appear to have an initial beneficial impact on glycaemic control in our patient population. Studies to assess whether this observation is sustained in the longer term are warranted to ensure the most effective risk reduction for our ASCVD patients.

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ORIGINAL ARTICLE

The Effects of a Weaning Protocol in ITU

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Background

Protocol driven ventilator discontinuation procedures have reduced ventilator days for patients in Intensive Care Unit (ITU) and are associated with better patient prognosis. In order to improve successful extubations, a weaning protocol was created for the Mater Dei Hospital (MDH) ITU using evidence-based criteria.

Aim

The purpose of this audit was to assess whether implementation of a mechanical ventilation weaning protocol had an impact on successful extubations as well as improved clinician and nursing knowledge regarding weaning.

Method

A prospective study was carried out to assess successful extubations before and after implementation of a ventilation weaning protocol. Adult patients who were ventilated for more than 7 days were included in the study. A questionnaire about mechanical ventilation and weaning was distributed to ITU physicians and nurses before and after implementation of the weaning protocol.

Results

We could not find any statistically significant differences in weaning success after the introduction of the weaning protocol. Information retention did not improve after usage of the protocol.

Conclusion

The introduction of an ITU weaning protocol at Mater Dei Hospital did not increase the number of successful extubations. Despite enhanced staff perception of weaning, a mechanical ventilation questionnaire did not improve retention of knowledge.

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INTRODUCTION

Mechanical ventilation is a standard of care in ITU, with respiratory support being necessary most commonly after respiratory, cardiac or neurological impairment. However invasive mechanical ventilation is a double-edged sword, with the possibility of ventilator-induced lung injury (VILI) or ventilator associated pneumonia (VAP), which increases with the duration of mechanical ventilation. According to the International Nosocomial Infection Control Consortium the overall rate of VAPs is 13.6 cases per 1000 ventilator days[1] with prolonged ventilation leading to a greater risk of ventilator dependency and death.[2] Indeed such risk is not constant but higher in the first week of mechanical ventilation.[3]

It is therefore ideal to wean patients as quickly as possible while still achieve successful extubation and discontinuation of mechanical ventilation. Weaning is the process of reducing ventilatory support to a point where a patient can breathe spontaneously unassisted. Weaning practices differ in different centres and countries as demonstrated by Burns et al[4] where 142 international ITUs utilised various directives, daily screening, ventilator modes and clinician roles in weaning.

Weaning success can be categorized into the following three groups[5]:

- Simple – ventilator discontinued after first assessment and weaning attempt
- Difficult – patients who fail their first weaning attempt and require up to seven days of ventilation
- Prolonged – ventilator discontinued after more than seven days from initial assessment

About 20% of mechanically ventilated patients require a more gradual and prolonged weaning process.[5] Causes for this are several, and include cardiac dysfunction, neuromuscular weakness and endocrine issues.

Previous studies have demonstrated that there is no superior method for weaning patients. Instead focus has shifted to implementation of weaning protocols that guide medical and nursing staff according to established practices.[6]

This research aims to assess the feasibility and impact of a new weaning protocol in our local ITU. We also sought to assess clinician and nursing knowledge regarding weaning and improve such knowledge.

The weaning protocol introduced in the Intensive Therapy Unit at Mater Dei Hospital was the result of an extensive literature review of best practices. We also considered local practices and needs. It was not intended for patients who were on short-term ventilation, had severe obesity or had suffered a spinal cord injury. Criteria were set when the clinician was guided to start the weaning process.

The protocol included patients with either a tracheostomy or an endotracheal tube. It also provided the following two alternative weaning processes: gradual pressure support reductions (PS) or the use of tracheostomy masks if a tracheostomy was present. The complete protocol is shown in **Digital Supplemental File 1**.

MATERIALS & METHODS

A prospective study of weaning practices was carried out before and after implementation of a ventilation weaning protocol in the Intensive Therapy Unit (ITU) at Mater Dei Hospital (MDH) from February 2020 to November 2021. Approval for the study was sought and obtained by University Research and Ethics Committee of the University of Malta (031220194123) as well as the Mater Dei Data Protection Office.

Adult patients (> 18 years) who were ventilated for more than 7 days were included in the study. Patients were excluded for the following reasons: <7 days ventilated, <18 years, BMI >40, spinal cord injury or COVID pneumonia/ARDS.

Data collected included the following: reason for admission, length of stay in ITU, number of days mechanically ventilated, number of failed extubations, complications after failed extubations, type of airway, method of weaning, use of spontaneous breathing trial, neurological or respiratory problems, presence of delirium and mortality.

Prior to the launch of the new weaning protocol, a questionnaire about mechanical ventilation and weaning was distributed to physicians and nurses working in ITU at MDH. After training of staff, the same questionnaire with the addition of three questions was re-distributed after implementation of the protocol to assess information retention and adherence. The questionnaire is described in **Digital Supplemental File 2**.

The primary outcome was the number of successful extubations before and after the implementation of the weaning protocol. The secondary outcomes included information retention by ITU staff, the total

ventilator days and mortality rate before and after implementation of the protocol.

Statistical Analysis

Data was transcribed into an MS Excel® file (Microsoft Washington US). Statistical analysis was performed with R (version 3.5.1), using R Studio (Version 1.1.442). A p-value of 0.05 was taken as significant. Univariate analysis was performed initially, using parametric or non-parametric tests where appropriate. The data was first checked for normality and skewness using visual methods, and other tests such as Shapiro's test of normality. When appropriate, t-tests, Mann-Whitney U tests, Kruskal-Wallis test and chi-squared tests were used for univariate analysis.

RESULTS

A total of 82 patients were recruited into this study. The demographics of both groups were similar, with the patients enrolled before the introduction of the protocol being non-significantly older. The majority of both groups were admitted to ITU for medical reasons (59% of all patients). This is shown in Table 1. Patients spent a median of 22 days (IQR: 14 – 38) in ITU, with a median of 17.5 days (IQR: 11.25 – 26] spent on a mechanical ventilator.

Following the introduction of the protocol, more patients were weaned with a tracheostomy mask, but this was not statistically different (Before: 45% vs After: 50%, p = 0.67). As shown in Table 2, there were no differences between outcomes in the two groups.

Table 1 Demographic data of patients enrolled in study before and after the implementation of a weaning protocol

	Pre-Protocol (n=40)	Post-Protocol (n=40)
Median Age (years)	62.5 [IQR: 50.75 - 73]	57 [IQR: 42 - 65.25]
Male (n / %)	30 (75%)	26 (65%)
Reason for admission (medical)	24 (60%)	24 (60%)
Underlying Respiratory Conditions	8 (20%)	5 (13%)
Neurological Problems	17 (43%)	16 (40%)

Questionnaire Responses

The questionnaire was distributed to 232 nurses and anaesthetists, see Table 3. In the pre-protocol phase, 61 participants answered the questionnaire. 61% of the participants were nurses whereas 39% were ITU doctors. The majority of participants had worked in ITU for more than 5 years.

Most participants (77%) could recognize signs that would prevent initiating weaning; however, far less (33%) could recognize the signs and symptoms that would halt weaning once started. 90% of participants knew the definition of the rapid shallow breathing index; however, only 31% knew the significance of its value. A minority of participants (21%) knew about a spontaneous breathing trial with far less (15%) knowing how to carry it out. Despite this, 49% of participants knew when a spontaneous breathing

Table 2 Differences in outcomes between the two study groups

	Pre-Protocol (n=40)	Post-Protocol (n=40)	p value
Median duration of ITU stay (days)	23 [IQR: 12.75 - 38]	21.5 [IQR: 15.25 - 37]	
Median duration of MV (days)	17 [IQR: 11.5 - 27.5]	18 [IQR: 11.25 - 21]	p = 0.97
Number of failed extubations	9 (23%)	13 (33%)	p = 0.46
Number of VAPs	5	4	
Airway type (tracheostomies)	23 (58%)	26 (65%)	
Tracheostomy mask weaning	18 (45%)	21 (53%)	
Pressures support weaning	22 (55%)	19 (47%)	
Delirium	8 (20%)	10 (25%)	
Mortality	17 (43%)	11 (28%)	p = 0.16

Table 3 *Questionnaire responses pre- and post-protocol implementation*

	Pre Protocol			Post-Protocol		
Question	**Total Correct (n/%)**	**Nurses**	**Doctors**	**Total Correct (n/%)**	**Nurses**	**Doctors**
4	47 / 77%	26	21	54 / 74%	29	25
5	8 / 13%	2	6	11 / 15%	3	7
6	20 / 33%	12	8	20 / 28%	11	9
7	50 / 82%	33	22	64 / 88%	37	27
8	10 / 16%	3	7	21 / 29%	5	16
9	4 / 7%	2	2	15 / 21%	8	7
10	9 / 15%	1	8	10 / 14%	1	9
11	15 / 25%	6	9	20 / 27%	8	12

trial should be performed. An overwhelming 87% of participants felt a protocol would improve the rate of successful extubation.

After implementing the protocol, the questionnaire was re-sent to assess information retention as well as user feedback. 73 participants responded with the majority being nurses (60%) and those that worked in ITU for more than 10 years (37%).

Information retention did not improve after usage of the protocol. However, overall attitude towards weaning was positive. This was evident in the second survey, which had additional questions regarding staff usage of the protocol. 82% of participants felt more comfortable with weaning after the introduction of the protocol. 83% felt it was easy to use while 67% of participants felt there has been an improvement in weaning from the ventilator.

DISCUSSION

Advanced age, more complex surgery and higher expectations have led to prolonged ventilatory weaning becoming an ever-increasing problem in most ICUs.[7] However there is a paucity of large prospective trials to help guide intensivists in decision-making for individual patients.

Multiple factors have been identified as potential contributors to prolonged ventilatory weaning such as positive fluid balance, neuromuscular diseases, advanced age and cardiac dysfunction. The relative frequency and degree of contribution of each individual factor among cohorts of patients requiring prolonged ventilation has not been defined.[7] Individual weaning predictors lack precision to guide clinical decisions; weaning strategies should thus incorporate non-physician-implemented protocols that utilize daily SBTs of progressively increasing duration after a certain level of ventilatory support reduction has occurred.[7]

Balas et al introduced an ABCDE bundle in nearly 200 patients in a single ICU, and compared ventilator outcomes in patients both pre and post implementation.[3] Patients who followed the ABCDE bundle underwent SBTs more frequently and experienced less mechanical support, more ventilator free days and less delirium. This effect was not small; patients in the post-implementation phase had 3 days less of mechanical ventilation. This occurred even in patients who initially failed an SBT.

One may also note the study by Jubran et al who attempted to assess the difference in outcomes between a gradual pressure-support reduction or use of a tracheostomy mask.[8] Patients included in this study had to undergo a trial period without mechanical support for a maximum of five days. Interestingly out of 500 patients enrolled, 160 passed this trial period with no further intervention.This shows how often mechanical support is weaned too slowly, and how simple clinical assessments may improve outcomes.

Prior to implementation of the weaning protocol in ITU at MDH, weaning practices varied between different specialists. There was no continuity to the weaning process, which may have led to increased ventilation duration.

Multiple studies have highlighted that clinical protocols reduce ventilation times.[9] Our experience does not support this, as there were no significant differences between the two groups. We postulate that our study was not powered enough to find such differences. Initially a larger number of patients were going to be enrolled, but this was hindered by the number of COVID patients

in ITU, which were excluded from this study. It is also possible that the education campaign might have failed to achieve its goals.

We also found that an educational campaign consisting of a PowerPoint presentation was not effective in collective data retention.

Prolonged ventilatory weaning mostly deals with those patients who have failed their first SBT; even though traditional weaning methods are still in widespread use, novel strategies have been introduced over recent years. New ventilation methods such as automatic tube compensation (ATC), adaptive support ventilation (ASV), mandatory minute ventilation (MMV) as well as pressure support-based automatic weaning systems are being gradually implemented in daily ICU practice; however, their impact on prolonged ventilatory weaning outcomes remains to be established.[10] This is one of the main reasons why they have not yet been included in the weaning protocol.

Automated closed loop systems for prolonged ventilatory weaning are also being steadily introduced in modern ICUs. These rely on specialised computer software which can adapt the ventilator's mechanical support to the patients' needs and hence facilitate their ability to breathe spontaneously with the aim of finding the optimal timing for weaning. The latest pooled evidence (adult and paediatric) indicates that automated closed loop systems reduce the mean duration of weaning by 32%.[11] However there is substantial heterogenicity present in the systems and protocols used across the trials. Even though more high-quality evidence is needed to fully appreciate the role of these systems in a mixed ICU, such automated protocols might be considered for our next weaning protocol update.[11]

A common clinical observation is that patients wean more rapidly from mechanical ventilation following tracheostomy. Even though theoretical considerations to explain this are not fully validated, some of its advantages are associated with optimisation of positioning, superior secretion removal, the ability to eat and speak, less laryngeal damage, better oral hygiene as well as sedation discontinuation.[12] The work of breathing is reduced by decreasing both artificial airway resistance and dead space.[13] These advantages are greatest in patients with long intubation times since tube coating with biofilm develops, further increasing airway resistance. Importantly the return to ventilation via the natural airways after decannulation is associated with an increase in the work of breathing[14], a fact that should be borne in mind when considering the timing of decannulation.

SUMMARY BOX

Known Findings

- Risk of VILI or VAPs increases with the duration of mechanical ventilation.
- Previous studies have demonstrated that there is no superior method for weaning patients.
- The focus has shifted to implementing weaning protocols to guide clinicians.

New Findings

- No statistically significant difference in weaning success after introduction of the weaning protocol.
- Information retention did not improve after usage of the protocol.
- Overall attitude towards weaning patients from mechanical ventilation was positive.

When dealing with difficult-to-wean patients, factors other than ventilatory protocols can impact weaning success; proper nutrition, physiotherapy as well as venue selection have all been implicated as potential contributors to successful weaning.[15] A recently discovered major contender as a contributor to weaning failure is the presence of underlying cardiovascular dysfunction. Early identification and prompt treatment of patients who are at high risk for weaning failure of cardiac origin is crucial in allowing the heart to tolerate more effectively the burden of weaning.

There are a number of limitations to our study, primarily that the population size of the study was small, and this may have reduced the power necessary to detect significant differences. The COVID-19 pandemic started during the post-implementation phase of the protocol. Since this population had particular lung pathology and were not included in the pre-implementation phase, data collection was interrupted until COVID numbers reduced. Furthermore there is no automated data collection in our unit, which means that such an observational study cannot be done retrospectively. This reduces bias, but also is more labour-intensive.

With regards to the impact of the educational campaign, staff retention of information did not improve after protocol implementation. There was a delay in sending the post-implementation

questionnaire, due to a number of protocols being introduced during the COVID pandemic. The long duration between teaching sessions and re-assessment could have had an impact on information retention. Furthermore there was a great turnover of nursing and medical personnel during this period. Since the questionnaires were anonymous, we could not match the pre- and post-responses.

The introduction of the weaning protocol should not be considered as a failure, however. It has helped junior doctors and nurses better assess patients during the weaning process. We would consider improving on the educational campaign by using interactive training sessions and providing feedback to staff on protocol use.

CONCLUSION

The introduction of an ITU weaning protocol at Mater Dei Hospital did not increase the number of successful extubations. Despite enhanced staff perception of weaning, a mechanical ventilation questionnaire did not improve retention of knowledge.

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ORIGINAL ARTICLE

Time to fluid administration in paediatric diabetic ketoacidosis

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Background

Diabetic ketoacidosis is a medical emergency and merits prompt fluid therapy. Our aim is to evaluate whether fluids are started within one hour of presentation to hospital for children with diabetic ketoacidosis.

Methods

This is a retrospective study involving patients with diabetic ketoacidosis presenting to paediatric emergency department at Mater Dei Hospital between 2008 to 2017. Diabetic ketoacidosis was defined as per local protocol. Times at hospital presentation, medical visits in emergency department and wards and at start of fluid administration were recorded. Clinical and biochemical parameters for patients with start of fluids within one hour (Immediate Fluid Treatment) were compared to those with delayed fluid treatment; T-test was used for significance.

Results

Sixty episodes were included, with 34 males (60.7%) and mean age 7.42 years. Fluids were started at a median of 95.5 (IQR: 70.5 - 128.3) minutes following presentation and were mainly started in the admitting ward. Only 18% of patients received fluids within one hour of presentation (n = 11). Bicarbonate and pH levels were significantly lower in these patients, at 7.87 vs 11.48 mmol/l (p = 0.027) and 7.07 vs 7.21 (p = 0.002) respectively, when compared to those with delayed fluid treatment. Significantly more patients in the immediate fluid treatment group needed fluid boluses (73% vs 29%, p = 0.0006).

Conclusion

Fluids were delayed more than one hour from presentation in most paediatric diabetic ketoacidosis patients. Consideration should be given to commencing fluids in the paediatric emergency department or expediting their ward transfer, to decrease this delay in starting treatment.

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Diabetic ketoacidosis (DKA) is the leading cause of death in children under 15 years of age with type 1 diabetes mellitus[1] and is associated with a mortality rate of about 0.25%.[2] It is a medical emergency, with the initial treatment priority being the restoration of extracellular fluid volume through the intravenous administration of 0.9% sodium chloride solution, followed by intravenous insulin. However there may be considerable time lags between time of presentation and time to starting fluids, which may lead to worsening of the patients' condition prior to starting treatment.

AIM

Our aim is to evaluate whether fluids are started within a target time of one hour of presentation to hospital for children with DKA. Our proposed outcome is a more efficient pathway to starting fluid treatment for paediatric patients with diabetic ketoacidosis if indicated.

METHODOLOGY

This is a retrospective study targeting children presenting to the paediatric emergency department (PED) at Mater Dei Hospital in Malta and diagnosed with DKA over a ten year period, between 2008 to 2017. The patients were identified from the paediatric endocrinology service records. Written authorisation was obtained from the chairperson of the Department of Child and Adolescent Health and the Data Protection Office at Mater Dei Hospital to access the relevant data. Additional ethics approval was not deemed necessary since this is a retrospective observational study and did not involve any patient contact or interventions.

The biochemical criteria for diagnosis of DKA were defined as per local protocol[3] namely:

1. Blood glucose > 11 mmol/l (capillary or venous sample)
2. Metabolic acidosis - one or both of:
    - Venous pH < 7.3
    - Serum bicarbonate < 15 mmol/l
1. Ketosis - either of:
    - Ketonaemia (capillary blood ß-hydroxybutyrate > 3.0 mmol/l)
    - Ketonuria (≥ 2+ or ≥ moderate)

Blood ketone monitors were not available during the study period, so only urinary ketones were used as diagnostic criteria.

The paediatric DKA protocol was updated in 2016[3] based on recommendations from the 2015 paediatric DKA guidelines for the UK National Institute for Health and Care Excellence[4] and the British Society of Paediatric Endocrinology and Diabetes.[5] The main change was an overall decrease in the amount of total fluids, with restriction of fluid boluses, a change in the calculation of maintenance fluids and a change in calculating fluid deficit depending on venous pH levels rather than based on clinical examination findings. There were no changes in diagnostic criteria or initial choice of fluid (0.9% saline).

All paediatric patients who were admitted via the PED and diagnosed with DKA were included in the study. Of note, the maximum admitting age to paediatric wards was increased from 14 to 16 years of age in January 2012. Patients receiving fluids elsewhere prior to presentation, those admitted to other hospitals and those not fitting the above criteria for diagnosis of DKA were excluded.

The 'time to fluids' was defined as the time from presentation to hospital, i.e. registration at the emergency department, to the time intravenous fluids were first administered, namely the initial time documented on the DKA fluid chart or, alternatively, the time at which a fluid bolus was prescribed, in the case of those patients needing fluid boluses.

Patients in whom fluids were started within 60 minutes from presentation were described as the 'Immediate Fluid Treatment' group (IFT) while those in whom fluids were delayed longer than 60 minutes from presentation were designated as the 'Delayed Fluid Treatment' group (DFT). Potential factors affecting time to fluids between the two groups were assessed, with T-test being used for significance.

The time to fluids was also broken down by time of presentation, time at triage, time at PED medical visit and time at ward medical visit, in order to enable analysis of factors contributing to the delay.

RESULTS

A total of 65 episodes of DKA were identified in 60 patients. 5 episodes were excluded because of admission to another hospital (n = 3), direct ward admission and bypassing PED (n = 1) or intravenous fluid administration elsewhere prior to presentation (n = 1). Therefore 60 episodes of DKA in 56 patients

were included in the analysis, with 3 patients having more than 1 episode of DKA.

Median age at presentation was 7.96 (Interquartile Range (IQR): 3.45 - 10.82) years and 60.7% (n = 34) were males. The change in maximum admitting age to paediatric wards from 14 to 16 years, in January 2012, led to a significant increase in the mean age of patients with DKA, from 6.56 years to 9.13 years (p = 0.02). DKA presentations peaked during the month of July. Peak presentation time occurred during late afternoon, with 33.3% of patients (n = 20) presenting between 16:01 to 20:00 hours. Only 12% of episodes (n = 7) occurred in known diabetics and none of these patients were on pump treatment.

78% of patients (n = 47) had a duration of symptoms lasting more than 48 hours before presentation, with 6 patients presenting within the first 12 hours, 5 patients with symptom duration between 13 to 24 hours, and 2 patients with symptom onset 25 to 48 hours prior to presentation.

Less than half of the patients referred to hospital were documented as having DKA on the referral ticket (18/38). Overall the majority of patients were diagnosed as having DKA during the PED medical visit (56.6%; n = 34). For the remaining patients, DKA diagnosis was first documented at reception (n = 7); at triage (n = 4) and during the ward medical visit (n = 15).

Mean values (± SD) for capillary blood glucose, venous pH and bicarbonate at diagnosis were 28.48 (± 6.75) mmol/l, 7.17 (± 0.12) and 10.59 (± 4.21) mmol/l respectively. Urine ketone levels were between 3+ to 4+.

Fluids were started at the PED for 11 patients (18%), with the remaining 49 patients receiving their initial fluids in the admitting ward. In keeping with this, venous access, and the time when the first venous blood gas was taken, was established in the ward for 72% of patients (n = 43). This is in contrast to capillary blood glucose which was checked in PED for 88% of patients (n = 53).

A significantly higher proportion of patients for whom fluids were started in the PED needed fluid boluses (8/11) when compared to those for whom fluids were started on the wards (14/49), with p = 0.006.

Fluids were started at a median of 95.5 (IQR: 70.5 - 128.3) minutes following initial presentation to the PED Fluid administration occurred within the one hour target time only in 12 DKA episodes (20%). There were no significant differences in time to fluids when comparing known diabetics (7/60) to the other patients (mean time 99.4 vs 105 minutes; p = 0.72) and for patients referred with DKA to those not referred with DKA (mean time 97.23 vs 107.32 minutes; p = 0.53).

There was no significant difference for clinical parameters between the IFT and the DFT groups, as shown in Table 1. These included age, heart rate, respiratory rate, GCS, capillary refill time (CRT), systolic blood pressure (BP) and diastolic BP There was variable documentation of parameters, with heart rate being documented in practically all patients (59/60) and Glasgow Coma Scale being the least documented (29/60). The only difference noted was the respiratory rate, which was higher in the IFT group, but the difference did not reach statistical significance.

When looking at DKA diagnostic criteria for the two groups, there was no significant change in capillary blood glucose, but pH and bicarbonate levels were significantly lower in the IFT group, as documented in Table 1. This is reflected in the significantly higher number of patients in the IFT group who needed fluid

Table 1 *Clinical and biochemical parameters for IFT and DFT groups*

Parameter or Result	IFT Group (mean values)	DFT Group (mean values)	*p*-value
Age (years)	6.58	8.26	0.22
Heart Rate (beats/min)	128	120	0.27
CRT (seconds)	2.7	2.4	0.50
Respiratory Rate (breaths/min)	45	27	0.14
GCS	13	14	0.26
Systolic BP (mmHg)	119	115	0.73
Diastolic BP (mmHg)	69	72	0.55
Capillary blood glucose (mmol/l)	30.5	27.7	0.16
pH	7.07	7.21	*0.002*
Bicarbonate (mmol/l)	7.87	11.48	*0.027*

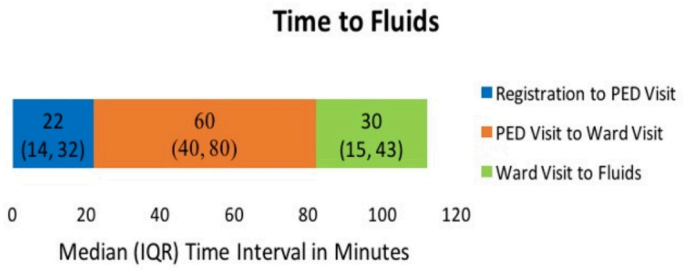

Figure 1 *Breakdown of time lag from presentation to start of fluids*

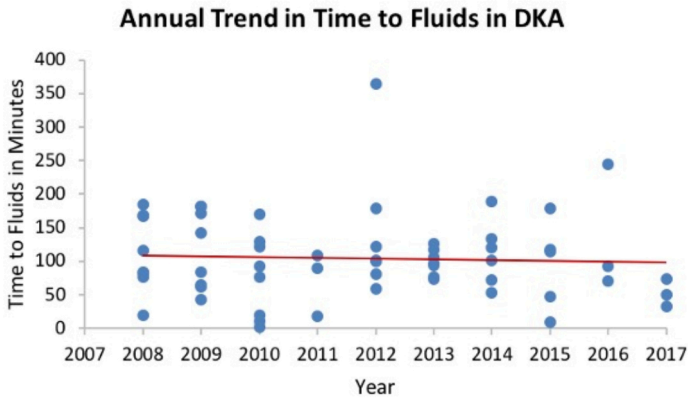

Figure 2 *Annual trend in time to fluids*

boluses when compared to the remaining patients (75% vs 23.9%, $p = 0.0009$).

Figure 1 shows the time delay which is broken down to three different timeframes. The median times from registration to PED visit was 22 (IQR: 14 - 32) minutes, from PED visit to ward visit 60 (IQR: 35 - 75) minutes and from ward visit to start of fluids 30 (IQR: 15 - 43) minutes. The longest delay occurred between PED and ward medical visits, with a median duration of 60 (IQR: 35 - 75) minutes.

The time to fluids remained constant over the ten year study period, as shown in Figure 2.

DISCUSSION

Intravenous fluid replacement should be started as soon as DKA diagnosis is confirmed.[6] There is no standard cut-off time advised for start of fluids in current DKA protocols in children or adults, but historically, a time to fluids of less than 30 minutes[7] or 60 minutes[8-9] in the Emergency Department was one of the standards recommended in the care of DKA.

Our study found a median time to fluids of 95 minutes. Studies involving adult DKA patients, mainly retrospective observational studies, have shown great variation in time to fluids, with one study by Singh et al showing a similar median time to fluids of 80 minutes (range 0 - 330 minutes).[7] However other studies have found that up to 80% of adult DKA patients receive appropriate fluid resuscitation in the initial hour following presentation.[8,10] The most recent study, by Edge et al[11], 2016, which compared treatment of adolescent patients with DKA in adult and paediatric units, found a similar time to fluids for both patient cohorts, with a median time to fluids of 34 (IQR:18 - 78) minutes for paediatric units and a time of 36 (IQR: 15 - 80) minutes for adult units. No other studies looking at time to fluids in paediatric DKA patients were identified.

Our time to fluids remained constant over the ten-year study period and was not impacted by changes in DKA protocol or admission age. The longest delays consistently occurred between the PED and ward medical visit, a time which also incorporates transfer time to the paediatric wards. In fact, most patients in the IFT group had their fluids started in the PED, thus avoiding this major delay to start of fluids. These patients had a higher respiratory rate, in keeping with worse acidosis (as evidenced by significantly lower pH and bicarbonate levels), which might have prompted the earlier venous access, investigations and initiation of fluids.

Venous access was established in the admitting ward for the majority of patients in our study, leading to a delay in the diagnosis of DKA. If venous access is performed at the PED, this would enable earlier diagnosis of DKA. This then raises the question of whether to start fluids at the PED or else expedite patient transfer to inpatient wards, to enable their initial management by the same medical personnel who are involved in their subsequent fluid management. Other potential barriers in our setting may have been the lack of blood ketone testing at the time of this audit and staff factors, with PED being manned by more junior staff than the inpatient wards.

Time to fluid administration has been shown to improve following regular educational sessions. One study by Freudenthal et al[9] showed an overall improvement in the rate of adult DKA patients receiving fluids within 60 minutes of arrival to ED from 58.6% to 74.1% over a four year period, following introduction of annual education sessions for acute medical staff. It is important to include emergency staff in training sessions since they will perform the initial management of these patients.

STRENGTHS AND LIMITATIONS

This is a retrospective observational study, but to our knowledge, we have included all paediatric DKA patients (rather than a representative sample). We also utilised a long time period of 10 years, in order to increase patient numbers.

CONCLUSION

Fluids were delayed more than one hour from presentation in the majority of paediatric patients with DKA. Consideration should be given either to commencing fluids in PED, to decrease this time lag in starting treatment, or else to more efficient transfer of these patients to the inpatient wards.

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ORIGINAL ARTICLE

Knowledge of Inhaler Technique and performing Peak Expiratory Flow Rate among healthcare professionals

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Background

Healthcare professionals should ensure that patients carry out an adequate inhaler technique. The aim of this audit was to assess the knowledge of healthcare professionals in performing a correct technique with two very commonly encountered devices, that is the metered dose inhaler (with spacer) and the turbohaler. Assessment of peak expiratory flow rate (PEFR) measurement technique was also done, since healthcare professionals should be able to monitor this parameter to aid detection of clinical improvement or deterioration.

Methods

The healthcare professionals involved equal numbers (25 of each group) of nursing staff, foundation trainees and medical basic specialist trainees. Assessment was performed by two observers with the use of a checklist for each technique.

Results

The turbohaler technique scored lower than the metered dose inhalers across all three groups, however there was no statistical significance when comparing the results of the three groups for the turbohaler technique. The highest scores were obtained in the medical specialist trainee group; results being statistically significant (p= <0.001) between the three groups with regards to metered dose inhalers and PEFR. The lowest scores were obtained in the nursing staff group.

Discussion

Education regarding inhaler techniques and PEFR should be a priority. Lack of knowledge from healthcare professionals would reflect on patients and this would lead to deterioration of disease control. Measures such as having printed guidelines in the ward for ease of reference, information leaflets and placebo inhalers can help improve education. If available, designated specialised respiratory nurses can also help in education for both healthcare professionals and patients.

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An adequate inhaler technique is paramount in the management of respiratory conditions mainly obstructive airway disease for optimal symptom control and quality of life.[1] Inadequate techniques are known to result in reduced disease control.[2] and are also associated with recurrent presentations to the emergency department[3] This is unfortunately common in patients suffering from asthma and/or COPD, as evidenced by a cross-sectional study performed by Melani et al, demonstrating that patients with poor inhaler techniques have lack of disease control, an increased risk of hospitalization and recurrent prescription of oral corticosteroids and antimicrobials.[4]

Therefore it is important that healthcare professionals who are prescribing inhalers as well as those providing the treatment itself, especially those who encounter acutely unwell patients in general medical wards, have this essential knowledge. Locally the most common encountered inhaler devices in the general medical wards are metered dose inhalers (with a spacer) and turbohalers.

Peak Expiratory Flow Rate (PEFR) monitoring is useful to assess the severity of an exacerbation of asthma, as well as to guide clinicians in monitoring disease activity.[5] Therefore knowledge on the technique on how to perform this useful bedside tool is crucial among healthcare professional caring for such patients in whom PEFR is being monitored.

AIMS

The aim of this audit was to assess knowledge on inhaler techniques with different inhaler devices as well as performing a PEFR among healthcare professionals who regularly encounter patients with respiratory conditions in acute medical wards. The secondary aim was to serve as an opportunity to educate these healthcare professionals who are not fully aware of how to use the different inhalers and perform PEFR monitoring.

MATERIALS AND METHODS

The audit was performed at Mater Dei Hospital the only general hospital in Malta and involved randomly recruiting foundation doctors, basic specialist trainees working in general medicine and nursing staff working in medical wards where patients with acute respiratory conditions are admitted, who agreed to participate in this audit.

Two medical doctors, the investigators, served as observers to score and record data, by providing a placebo inhaler device and a PEFR device to the participants, who were instructed to demonstrate the techniques on themselves. All data was recorded in a private document in an intranet server accessible only to the investigators. All data was anonymized and deleted on completion of the audit.

The inhaler technique assessed utilized the commonly encountered devices in our hospital, namely a metered dose inhalers with a spacer and a turbohaler. Health care professionals were given scores on each technique used. Each step performed correctly was given one point, as follows (adapted from the 'NHS Liverpool Inhaler Technique Checklist'.[6]):

- Metered Dose Inhalers
  with Spacer (Maximum score of 8):

  1. Remove cap, hold inhaler upright and shake well.
  2. Insert inhaler upright into the hole in the spacer.
  3. Breathe out gently as far as is comfortable.
  4. Put mouthpiece on spacer between teeth without biting and close lips to form a good seal.
  5. Hold spacer level and press down firmly on the canister to release one puff: Breathe in slowly and deeply then hold breath for about 10 seconds or as long as comfortable. Breathe in and out normally for 4 breaths.
  6. Remove spacer from mouth and breathe out gently.
  7. Repeat steps above if 2nd dose is required. You need to shake the canister again and ideally wait 1 minute between inhalations.
  8. Remove inhaler from spacer, and replace cap. Check that patient knows how to clean spacer each month (if relevant).

- Turbohalers (Maximum score of 7):
    1. Unscrew and remove the mouthpiece cover.
    2. Keep turbohaler upright whilst twisting the coloured bottom grip in one direction, then the other direction as far as it will go until a click is heard.
    3. Breathe out gently as far as is comfortable.
    4. Place mouthpiece in mouth, between teeth without biting and close your lips to form a good seal.
    5. Breathe in quick and as deeply as possible.
    6. Hold your breath for 10 seconds and then remove Turbohaler from your mouth and breathe out slowly.
    7. Replace cover, if second dose is required repeat steps above.

- The PEFR method (Maximum Score of 5):
    1. The individual should be either sitting down or standing.
    2. The marker on the PEFR meter should be set to zero.
    3. Attach mouthpiece to PEFR meter.
    4. Breathe in as much as possible, then followed by a rapid forced exhalation into the mouthpiece.
    5. This should be repeated for a total of three times, and the best value should be recorded for monitoring the technique.

A student t-test and one-way ANOVA were used for comparison of means. Microsoft excel (2019 version) was used for the former and an online calculator was used to calculate the latter(7). A p-value of <0.05 was taken to be statistically significant.

RESULTS

A total of 75 participants completed the assessment on the knowledge of how to perform a metered dose inhaler, a turbohaler and a PEFR These included equal numbers of nursing staff who work in general medical wards (n=25), foundation trainees (n=25) and basic specialist trainees in general medicine (n=25). Six participants in each of the foundation trainee group and basic specialist trainee group had experience in a respiratory medicine rotation. Table 1 and Figure 1 shows the results obtained among healthcare professionals for the inhaler and PEFR techniques.

When comparing inhaler technique of the two devices, it is evident that turbohaler technique is less known that the meter dose inhaler technique. However when comparing the scores between the three groups with regards to turbohaler technique, it does not yield statistical significance. When comparing the mean scores of the groups on metered dose inhalers, there is statistical significance (p= <0.001). The lowest PEFR method score was observed in the nursing staff group, with the highest score among the medical basic specialist trainees, the different scores between the three groups are also statistically significant (p= <0.001).

Table 1 *Mean Scores achieved for inhaler and PEFR techniques.*

	Nursing Staff (n=25)	Foundation Trainees (n=25)	Medical Basic Specialist Trainees (n=25)	p-values	Range
Mean Age(±SD), years	32.2(±8.07)	25.1(±1.57)	28.6(±1.18)		22 - 54
Mean Metered Dose Inhaler Score(±SD) (Maximum of 8)	5.4(±1.36)	6.4(±1.47)	7.8(±0.44)	*< 0.001*	3 - 8
Mean Turbohaler Score (±SD) (Maximum of 8)	3.2(±2.2)	4.1(±1.71)	4.3(±1.34)	.099	0 - 8
Mean PEFR Method Score (±SD) (Maximum of 5)	2.2(±1.74)	4.1(±0.83)	4.9(±0.28)	*< 0.001*	0 - 5

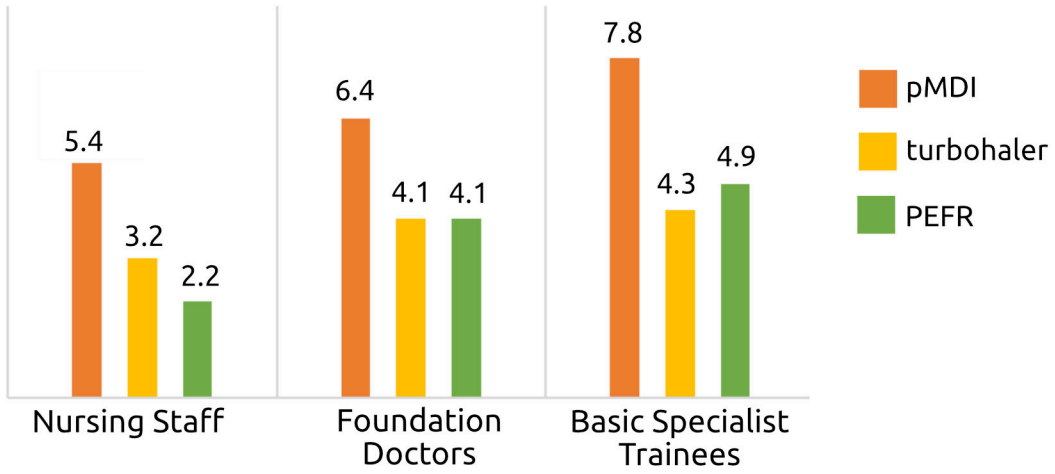

Figure 1 *Mean scores on inhaler techniques and PEFR measurement techniques between groups*

DISCUSSION

Patients with asthma are at an increased risk of exacerbations and morbidity if inhaler technique is inadequate. According to Global Initiative for Asthma (GINA) 2021, up to 80% of patients do not have adequate knowledge on proper technique[8] Poor techniques are commoner in older and poorly educated patients, however there is also an association between poor technique and lack of demonstration by healthcare professionals.[9] The latter is avoidable and lack of education prior to discharge may result in increased re-hospitalization rate and recurrent treatment with systemic corticosteroids and antibiotics.

Poor techniques are also unfortunately present in the COPD population, especially with those having a lower level of education.[10] In a cross-sectional study on patients with COPD by Pothirat et al, the poorest technique was with the use of pressurized metered dose inhalers.[10] The latter can also be attributed to a lack of adequate instruction from the prescriber; as evidenced in a multicentric study by Plaza and Sanchis\(1998\).[11] assessing metered dose inhaler technique of 428 physicians, only 28% demonstrated a correct method. When comparing the latter to our audit, the data is also consistent with physicians scoring better in techniques when compared to nursing staff.

A demonstration by a healthcare professional significantly increases the likelihood of an adequate technique[12], for example by utilising placebo inhalers and spacers. Re-education is also very important for both patients and healthcare professionals, since knowledge on techniques could wane over time. This could be aided by providing a pictorial or videographic demonstration of the inhaler techniques of the most common devices as well as the PEFR technique, depending on the patient requirements. Several online sources are available for the demonstrating the method of utilising the particular device, including the official GINA website[8]

Lack of professional healthcare knowledge on inhaler techniques is also a well-known phenomenon. It is estimated that between 39% to 67% of nursing staff and physicians are unable to demonstrate appropriate techniques.[13] The least known technique across all groups in our local cohort was turbohaler use, most likely since it is less commonly prescribed when compared to metered dose inhalers. When comparing knowledge among medical doctors, all techniques improved with increasing seniority, suggesting that training should be encouraged from the start of medical training.

Possible measures leading to enhanced education through healthcare professionals include having available printed guidelines in the ward on the proper techniques, as well as possibly having designated respiratory specialised nurses who would be available to educate both professionals and patients. Availability of placebo inhalers in a ward setting would also be helpful, since this method is known to highly effective.[14] A detailed information leaflet provided to patients could also prove to be beneficial, especially in an outpatient setting.

PEFR measurement is considered an important parameter to monitor in patients who are admitted with exacerbations of obstructive lung disease such as asthma[5], thus the importance of continued education in this commonly performed procedure should be stressed. In our audit, it was also demonstrated that PEFR technique is most lacking in the nursing staff group, and to a lesser extent among

medical doctors. International data is lacking regarding auditing of PEFR measurement, this should be encouraged in order to maintain standardization of an adequate technique.

CONCLUSION

Our results show that knowledge with regards to inhaler technique and performing a PEFR is lacking among healthcare professionals, particularly among nursing staff. Since most healthcare professionals encounter patients using inhaler treatment on a regular basis, widespread education is necessary for optimal respiratory disease control and quality of life in our patients.

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SUMMARY BOX

- Inhaler techniques are paramount for management of asthma and COPD, lack of education can lead to deterioration in disease control
- Lack of adequate techniques is well described in literature for both patients and healthcare professionals
- In this audit, it was demonstrated that a lack of knowledge is also present locally in both nursing staff and medical doctors with regards to adequate technique for inhalers and PEFR measurement
- Education should be implemented, with the use of printed guidelines or information leaflets, in order to improve patient care

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ORIGINAL ARTICLE

The Experience of Uncertainty amongst Doctors working within Primary Healthcare in Malta

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Background

This is a cross-sectional observational quantitative study, with the aims of assessing experiences of uncertainty amongst doctors practising in primary healthcare in Malta and identifying contributing factors and management strategies for uncertainty.

Methods

An online anonymous questionnaire was formulated and doctors working in primary healthcare in Malta were invited to participate. Demographic data relating to years of practising experience, local training and public or private practice, was asked for. The revised physicians' reaction to uncertainty (rPRU) questionnaire, developed by Gerrity et al. in 1995, was used to obtain quantitative data on doctors' experiences of uncertainty, on which hypothesis testing was carried out to identify subgroups who experienced more uncertainty. Finally, respondents were asked which factors contribute to uncertainty in their practice and which management strategies they use.

Results

Data from 77 respondents was obtained. Hypothesis testing of rPRU scores showed statistically significant differences between males and females (p=0.033), trainees and their seniors (p=0.004), and groups with varying practice experience (p=0.018). No statistically significant difference was noted between doctors in private and public sectors, and doctors trained or training and those not trained with the local specialist training programme. Ambiguous illness presentation, separation of medical notes between primary and hospital care, and lack of continuity of care, contribute most to uncertainty in family medicine according to respondents. To address uncertainty, most respondents encourage patient reviews, share decision-making and explain red flags to patients.

Conclusion

Better support is needed for doctors to manage uncertainty in their practice, where continuity of care is an essential strategy.

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Uncertainty is inherently a major constituent of primary healthcare, sometimes even being referred to as one of the biggest hurdles the family doctor faces daily.[1] Uncertainty can be a significant source of stress and anxiety to both doctor and patient and indeed, trainees in family medicine are often advised to accept uncertainty as an inevitable part of primary healthcare.

However intolerance to uncertainty among both the primary care physicians and their patients can affect the medical decision-making process, as doctors may feel pressured to uncover illness at the earliest whilst patients may demand more investigations, despite the doctors' awareness that excessive testing and referrals may be harmful, beyond medical guidelines and evidence.[2] An inability to manage uncertainty in family practice well can lead to longer consultations and professionalism issues.[3]

Intolerance to uncertainty in primary care physicians has also been associated with burnout and low compassion satisfaction[4], thereby having negative effects on doctors' wellbeing during work hours, but potentially even in their personal lives. In a Maltese study by Baldacchino and Abela intolerance to uncertainty and challenges in its management were found to discourage foundation doctors from continuing their careers in family medicine.[5]

It is therefore worth comprehending the characteristics and factors which increase such uncertainty in family medicine, to address it and subsequently improve the primary healthcare service to patients.

Although this subject has been the basis of many qualitative literature and research, fewer quantitative studies have been produced. Quantitative data may be able to better demonstrate the magnitude of uncertainty in family medicine and has better comparability.

This is a retrospective cross-sectional observational study, with the aims of assessing the experiences of uncertainty in doctors practising in primary healthcare in Malta and identifying factors which increase such uncertainty, as well as strategies used to manage it. In so doing, this study may also indicate which subgroups of doctors experience more uncertainty, and who are possibly using maladaptive measures to try tackling uncertainty in their practice.

This information can be used to improve healthcare systems in family medicine, as doctors and patients can be supported further.

MATERIALS AND METHODS

Study Setting

Primary healthcare in Malta is split in two sectors – public and private. In the national tax-funded public sector, ten primary health centres and other smaller district clinics are currently operating throughout the Maltese islands.[6] The services of family doctors are mainly available through walk-in and only recently, in certain instances, by prior appointment.

Family doctors practising in the private sector are more widespread throughout the islands and may serve at their own or at a pharmacy clinic. However they often operate alone and unlike in the public sector, clinical notes and IT systems used in tertiary healthcare may not be available.

In 2007, the Specialist Training Programme in Family Medicine (STPFM) was launched for junior doctors wishing to specialise in family medicine, with the aim of "focus[ing] on the learning needs of family medicine", through a three-year programme overseen by trainers in family medicine and supervisors during hospital placements.[7]

Study Design and Participants

To gather data, an online questionnaire was created using Google Forms. The questionnaire was written in British English. To avoid missing data, all question fields were marked as mandatory to answer.

The questionnaire was split into four sections:

- demographic data
- the revised physician reaction to uncertainty (rPRU) questionnaire
- factors contributing to uncertainty in family practice
- strategies used to manage such uncertainty.

Statements were designed as closed questions, however in the third and fourth sections, participants had the option to elaborate further through free text. The full questionnaire is included in **Digital Supplementary File 1**.

This questionnaire was sent to the principal general practitioners of health centres in Malta and was then distributed by email to all doctors employed in their respective primary care institutions, together with an

invitation to participate. The questionnaire was also sent to members of the Malta College of Family Doctors' Google group, which includes family doctors exclusively practising in the private sector. Hence participation was on a voluntary basis only and subjects were recruited only by approaching their respective institutions or associations. All doctors working in primary healthcare in Malta were eligible to participate.

Data was collected between the 13th and 22nd March 2021 and was stored and analysed in Microsoft Excel.

This study was deemed exempt from ethics review however participants were told the intention of the study in an invitation letter attached to the questionnaire. A contact email address was also provided to potential participants to address any queries. Data remained anonymous and was not shared with third parties.

The demographic data gathered includes gender, age, number of years practising, and professional role. Respondents were also asked whether they practise in the private sector and whether they have undergone or are currently undergoing the STPFM in Malta.

In the second section, the rPRU questionnaire was implemented, a copy of which is also provided in **Digital Supplementary File 1**. This is a validated questionnaire developed in 1990 by Gerrity et al to measure physicians' affective reactions to uncertainty, and later revised in 1995.[8] It presents a total of fifteen statements, divided in four sections – 'Anxiety due to uncertainty' (five items), 'Concern about bad outcomes' (three items), 'Reluctance to disclose uncertainty to patients' (five items), and 'Reluctance to disclose mistakes to physicians' (two items). In the revised version of this questionnaire, Gerrity et al group the first two sections as 'Stress from uncertainty' and the last two sections as 'Reluctance to disclose uncertainty and mistakes'. Therefore for simplicity's sake, this latter arrangement was utilised for this study.

Statements were scaled on a six-point Likert scale, that is 'strongly agree', 'moderately agree', 'slightly agree', 'slightly disagree', 'moderately disagree', 'strongly disagree', wherein each response in the Likert scale for each of the fifteen statements was scored differently. Scores of the two main sections of the rPRU questionnaire, i. e. 'Stress from Uncertainty' and 'Reluctance to Disclose Uncertainty and Mistakes', as well as their total, were calculated for each respondent. Higher scores indicated higher levels of stress from uncertainty and/or increased reluctance to disclose uncertainty and mistakes.

Mean scores and variances were then calculated, as needed. Hypothesis testing was carried out in Microsoft Excel. Statistical significance was set at a probability (p) value of less than 0.05.

The t-test of independence was used to compare mean scores of the rPRU questionnaires between male and female respondents, between trainees (foundation doctors and trainees in family medicine) and their seniors (family doctors, senior family doctors and principal family doctors), between doctors practising in the public sector and those practising in the private sector, and between doctors trained or currently undergoing training with the STPFM and those not trained with the STPFM.

Single-factor ANOVA hypothesis testing was employed when comparing variance between doctors of ten years or less (≤10) of practicing experience, doctors of eleven to thirty years[11-30] of practicing experience, and doctors with more than thirty years (>30) of practicing experience.

In the third and fourth sections of our online questionnaire, we asked respondents which factors contributed to feelings of uncertainty in their practice and what strategies they used to manage such uncertainty, respectively. Respondents were able to tick more than one box in these sections and had the option of writing free text to elaborate further should they wish to do so.

This study adhered to the STROBE statement guidelines for cross-sectional studies.

RESULTS

A total of 77 respondents completed the questionnaire. The demographic characteristics of the study population are visualised in **Table 1**.

The total score of the rPRU questionnaire, as well as scores of its two main sections, 'Stress from uncertainty' and 'Reluctance to disclose uncertainty and mistakes', were compared between groups. Statistical significance at a p-value of less than 0.05 was obtained when comparing 'Stress from uncertainty' scores and the total rPRU scores in males and females. This was also the case when comparing 'Stress from uncertainty' scores, 'Reluctance to disclose uncertainty and mistakes' scores, and the total rPRU scores in trainee doctors and their seniors. Again statistical significance was obtained when

Table 1 *Characteristics of the study population, showing respondents' gender, age, number of years of practicing experience, professional roles, whether they practice in the private sector, and whether they were or are currently undergoing training with the Specialist Training Programme in Family Medicine (STPFM) in Malta*

Characteristic	n (%)
Sex	
Total	77 (100)
Male	47 (61.0)
Female	30 (39.0)
Clinical Practice (years)	
≤10	26 (33.8)
11 - 30	23 (30.0)
>30	28 (36.3)
Practicing Sector	
Public	30 (39.0)
Private	35 (45.5)
Age (years)	
21 – 30	18 (23.4)
31 – 40	17 (22.1)
41 – 50	6 (7.8)
51 - 60	22 (28.6)
Professional Role	
Foundation doctors	3 (3.9)
Family doctor trainees	12 (15.6)
Family doctors	38 (49.4)
Senior family doctors	22 (28.6)
Principal family doctors	2 (2.6)
Formal Family Medicine Training	
Current or Completed training	35 (45.5)
No formal training	42 (54.6)

comparing 'Reluctance to disclose uncertainty and mistakes' scores and the total rPRU scores among groups of doctors with differing years of practice experience.

No statistically significant difference was noted when comparing scores between doctors who practice privately and those in the public sector, and between doctors who were trained or training with the STPFM and those not trained with the STPFM. Results of this analysis can be seen in Table 2.

When addressing factors which contribute to feelings of uncertainty in primary healthcare, most respondents (n = 56, 72.73%), stated 'ambiguous or vague presentation of illness' as one such factor which they encountered in their practice.

'Having separate medical notes between primary care and hospital care' was the second most agreed upon factor which contributed to uncertainty (n = 47, 61.03%,), whilst 'lack of continuity of care' was the third most agreed upon factor (n = 45, 54.44%,).

Asked which strategies respondents use to cope with feelings of uncertainty in their practice, most stated that they ask patients to come for a future review (n = 65, 84.41%,).

64 respondents (83.12%) stated they share decision-making with the patient. 62 respondents (80.52%) stated that they explain red flags and warning signs to patients, whilst 61 respondents (79.22%) stated that they seek to identify patients' main concerns.

Responses to the third and fourth sections of the questionnaire can be visualised in Table 3 and Table 4 respectively.

DISCUSSION

The Maltese medical council register of family medicine specialists [9] has 63.72% male and 36.08% female family doctors currently registered at time of writing. For the sake of comparing like with like, when excluding study respondents who were still in training, 66.13% (n = 41) were males and 33.87% (n = 21) were females. This makes this section of the study population representative for gender.

A considerable proportion of doctors in our study population reported more than 30 years of practising experience (36.4%) while of trainee respondents was proportionally lower totalling 19.5% of the total study cohort. Therefore a representative skew towards senior doctors can be inferred from the study results.

Table 2 *Results from statistical hypothesis testing of the revised physicians' reaction to uncertainty (rPRU) scores in 77 doctors working in primary healthcare in Malta*

	Stress from Uncertainty Score		Reluctance to Disclose Uncertainty and Mistakes Score		Total rPRU Score	
	Mean	**p value**	**Mean**	**p value**	**Mean**	**p value**
Gender						
Male	26.1	*0.036*	18.1	0.27	44.2	*0.033*
Female	30.6		19.5		50.2	
Level						
Trainee Doctors	32.9	*0.025*	21.7	*0.025*	54.6	*0.004*
Senior Doctors	26.7		18.1		44.8	
Experience						
≤10 years	*100.4		*26.9		*144.6	
11-30 years	*77.6	0.089	*25.6	*0.026*	*130.6	*0.018*
>30 years	*65.9		*37.2		*138.0	
Working place						
Private Sector	26.9	0.45	17.4	0.12	44.3	0.198
Public Sector	28.5		19.5		48.0	
Trained or training with STPFM						
Yes	28.1	0.88	17.9	0.28	45.9	0.70
No	27.7		19.3		47.0	

** The indicated numerical figures are variances, not mean scores, as single-factor ANOVA hypothesis testing was used to compare differences between groups.*

The rPRU questionnaire was used to identify subgroups within the study population who experienced more uncertainty in their practice. Such uncertainty can lead to negative affective reactions within the physicians as measured by the 'Stress from uncertainty' scale in the rPRU The physician may also exhibit particular maladaptive behavioural responses to uncertainty, such as an unwillingness to admit uncertainty and misjudgements in patient management and may feel disinclined to discuss and reflect on experiences of uncertainty with colleagues and patients, as measured by the 'Reluctance to disclose uncertainty and mistakes' scale in the rPRU questionnaire.

It is well-documented that anxiety, and indeed anxiety disorders [10], are more prevalent in women. In our study, female doctors were observed to have higher 'Stress from uncertainty' scores on the rPRU questionnaire than male doctors, which was statistically significant at p = 0.036. However no statistically significant difference was shown in 'Reluctance to disclose uncertainty and mistakes' between genders. This suggests that the female doctors in our cohort felt more stressed in the face of uncertainty in their practice than their male counterparts. However maladaptive responses to uncertainty, with reference to reluctance to disclose uncertainty and mistakes with patients and colleagues, were not associated with gender.

When comparing the total rPRU scores in groups of doctors with different years of practise experience, i. e. ≤10 years, 11-30 years and >30 years, a statistically significant difference emerged (p = 0.018). Similarly comparison of rPRU scores between trainee doctors and their seniors showed statistically significant differences in both the 'Stress from uncertainty' and the 'Reluctance to disclose uncertainty and mistakes' categories (p = 0.025 and p = 0.025 respectively). This agrees with findings from Cooke et al's study carried out among Australian trainees in family medicine [11], as well as from Politi et al's study among primary care physicians [12]

Experience helps junior doctors to learn skills to deal with uncertainty in medicine. Trainees might be more

Table 3 *Factors contributing to uncertainty in family medicine, as stated by 77 doctors working in primary healthcare*

	n	%
Ambiguous or vague presentation of illness	56	72.7
Having separate medical notes between primary care and hospital care	47	61.0
Lack of continuity of care as outcomes of consultations remain unknown	45	58.4
Limited availability of quick investigations, including point-of-care blood tests, ECG's and imaging modalities	43	55.8
Stressful work environment	36	46.8
Limited knowledge/practice in primary healthcare	28	36.4
Doctor's high expectations for him/herself	27	35.1
Patients' inappropriate prioritization of problems	27	35.1
Patient anxiety	25	32.5
Lack of comprehensiveness in medical records in primary healthcare	22	28.6
Doctor's negative past experiences	21	27.3
Lack of information available on logistical protocols in primary healthcare and hospital care	21	27.3
Doctor's low self-esteem	20	26.0
Limited time spent during patient consultation	19	24.7
Doctor's anxiety and stress	18	23.4
Medical knowledge/practice focused on acute care rather than on primary healthcare	17	22.1
Limited skill/experience in diagnostic and clinical reasoning skills	17	22.1
Lack of other resources	17	22.1
Lack of support available from colleagues and/or administrative staff	15	19.5
Lack of positive feedback from peers	12	15.6
More familiarity with working in a team, rather than solo	11	14.3
Patient dissatisfaction with outcome of consultation	11	14.3
Limited access to learning new evidence-based methods of care	10	13.0
Limited communication skills	5	6.5
Other: Limited GP empowerment	1	1.3
Other: EPR can be slow, very hard to refer to, and not efficient	1	1.3
Other: "Patients always expecting a diagnosis and their belief that all ailments have a medical 'diagnostic tag' which a GP in his limited clinic should arrive to."	1	1.3
Other: "Management of uncertainty is a key primary healthcare skill"	1	1.3
Other: "COVID19 posing a constantly changing situation"	1	1.3

Table 4 *Strategies used to manage uncertainty in family medicine, as stated by 77 doctors working in primary healthcare*

	n	%
Asking the patient to come again for a review in the near future	65	84.4
Sharing decision-making with the patient	64	83.1
Explaining red flags and warning signs to patients	62	80.5
Seeking to identify the patient's main concern	61	79.2
Safety netting	58	75.3
Referring the patient to a field specialist for assessment and management	54	70.1
Asking for help or advice from colleagues or seniors	53	68.8
Accepting that uncertainty is inevitable	51	66.2
Looking up information during the patient consultation	46	59.7
Communicating your uncertainty with the patient	44	57.1
Looking up evidence-based research and guidelines	37	48.1
Allotting more time to the patient consultation	34	44.2
Reflecting after the patient consultation, identifying skills which need to be improved and implementing ways to do so	31	40.3
Ordering tests and investigations to avoid missing anything	29	37.7
Teaching younger doctors and engaging in discussion, thus using this as a means of refreshing memory and keeping yourself up to date	22	28.6
Sleeping on it and thinking about the particular problem even during non-working hours	15	19.5
Prescribing medications/treatment that may be necessary in the future, but not at present	13	16.9
Other: "Keeping up to date especially with things being done abroad - maintaining contact with a good support network"	1	1.3

familiar with seeing the acute phase of illness and are still developing their diagnostic and clinical reasoning skills.[3] They can also feel stripped from the reassurance of working in a large team, as they now work more independently in primary care.[3] Trainees are generally encouraged to discuss thoughts and concerns with their more-experienced supervisors and seniors, as this in itself serves as a useful tool in dealing with uncertainty[10] as this can help doctors reflect on their patient consultations, identify what should be improved and formulate solutions to do so.

rPRU scores of doctors practising in public and private sectors were also compared using hypothesis testing, however no statistically significant difference emerged. This is despite that private family doctors tend to be more limited in resources, such as restricted access to hospital medical notes and limited investigations, and despite the more solitary environments private doctors usually practise in. This result indicates that the private family doctors in our study population may have developed ways to manage uncertainty and balance any disadvantages they may have compared to the public sector. Such adaptations can be achieved through experience, especially when considering that n = 20 (64.52%) from our total of 31 doctors who practise privately have more than 20 years' practising experience, as well as other strategies to manage uncertainty which will be discussed later in this section.

Finally when comparing rPRU scores among doctors trained or currently training with the STPFM and those not trained with the STPFM, no statistically significant difference was noted. As the STPFM was

launched in 2007, doctors studying before did not have a local specialised training programme available to them. This result implies that these doctors may utilise alternative educational tools to continue and improve their professional development, which help them adapt to deal with uncertainty in their practice.

Uncertainty can be attributed to various interplaying factors. These may be disease-centred, such as presentations which are vague or at the early stages of disease, making diagnosis difficult. Factors contributing to uncertainty may also be patient-centred – for example, patients might prioritise problems differently and have underlying psychosocial and economic challenges which may complicate patient management. They may even be doctor centred. Here inexperience and limited diagnostic and clinical reasoning skills may be concerning especially for trainees.[3] The doctor's personality traits such as neuroticism, may also come into play and further increase stress from uncertainty.[13]

61.04% (n = 47) of doctors in our cohort stated that having separate medical notes between primary and hospital care contributes to uncertainty. In 2020, the electronic patient record (EPR) system for Maltese primary healthcare was launched and is currently utilised in the public sector[14], however its uptake by private family doctors has been less than desirable.

58.44% (n = 45) of doctors stated that lack of continuity of care adds to uncertainty as outcomes of consultations remain unknown. In a Maltese study looking at patients' experiences in private and public sectors of primary healthcare, Pullicino et al indicated that the private sector offered better continuity of care[15], which is one of the key characteristics of family medicine, as outlined by European Academy of Teachers in General Practice in their definition of general practice.[16]As public-sector health centres are manned by different doctors, continuity of care can be challenging especially for walk-in patients. To address this, appointment clinics have started operating in 2021, where patients can make future appointments with the same primary care physician. However patients with urgent complaints who attend public-sector primary health centres would still be seen as walk-in cases by the doctor available at the time.

Lastly in our questionnaire, doctors were asked which strategies they use to manage uncertainty in their practice. 84.42% (n = 65) stated that they recommend patients to come again for a follow-up appointment, thereby maintaining continuity of care. 83.12% (n = 64) stated they share decision-making with patients, taking into consideration their needs and preferences using a non-paternalistic approach. According to the National Institute for Clinical Excellence shared decision-making has the advantage of making sure patients comprehend benefits, harm and possible outcomes of different management options. It also empowers them to make informed decisions about their management.[17]

Doctors in our study population also stated that they manage uncertainty by explaining red flags and warning signs to patients (n = 62, 80.52%), they seek

SUMMARY BOX

What is already known?

- Uncertainty is frequently encountered in family medicine and it may lead to stress in both primary care physicians and patients.
- Intolerance to uncertainty among both the primary care physicians and their patients can lead to longer consultations, doctor professionalism issues, and affect the medical decision-making process. It has also been associated with burnout and low compassion satisfaction in primary care physicians and was one factor which discouraged junior doctors from continuing their careers in family medicine.
- Qualitative literature and research uncertainty in family medicine have been published, wherein management strategies are also recommended. However fewer quantitative studies have been produced.

What are the new findings?

- Negative affective reactions to uncertainty were present more among female doctors and trainee doctors. Maladaptive behaviours in reaction to uncertainty were present among trainee doctors.
- Ambiguous presentations of illness, having separate medical notes between primary and hospital care, and lack of continuity of care, contribute to uncertainty in family medicine.
- To manage uncertainty in family medicine, doctors encourage patient reviews, share decision-making with patients and explain red flags.
- Further support for doctors is needed to manage uncertainty in family medicine in a healthy manner. Primary healthcare clinics can also help in doing so through centralised national healthcare IT systems and appointment clinics to maintain continuity of care.

to identify patients' main concerns (n = 61, 79.22%), and they perform safety netting in their consultations (n = 58, 75.32%). These principles are encompassed in the Calgary-Cambridge referenced observation guide, as developed by Kurtz and Silverman in 1996, which delineates skills for effective communication between doctor and patient.[18]

LIMITATIONS

As recruitment to the study was voluntary, sampling bias may have occurred, especially given the fact that a larger proportion of older family practitioners were present in our study population. The skewed population could have affected data interpretation.

This study assesses the experience of uncertainty in doctors working in primary healthcare and does not explore if and how this uncertainty affects management of the patient's illness or patient satisfaction with the consultation, as it was not the scope.

Moreover the study population did not only include qualified family doctors (80.5%) but also trainee Family Doctors (15.6%) and 3 (4%) Foundation Doctors who, despite showing interest in Family Medicine might not eventually opt for working in the family medicine specialty.

CONCLUSION

By means of a quantitative validated tool, this study showed that negative affective reactions to uncertainty were present more among female doctors and among trainee doctors. Maladaptive behaviours in reaction to uncertainty were present among trainee doctors. Better support is needed for primary care physicians to manage uncertainty in their practice, through self-reflection and discussions with colleagues and supervisors, as this may help in coming up with healthy ways of management of uncertainty. Having separate medical notes between primary and hospital care, and a lack of continuity of care can further contribute to uncertainty in family medicine. These can be managed by encouraging widespread use of a centralised electronic patient record system and increasing accessibility of hospital IT systems to doctors in primary healthcare, both in the private and public sectors, to maintain continuity of care and decrease uncertainty. Utilisation of appointment clinics also help maintain continuity of care and may also provide a protected time slot for the doctor-patient consultation.

Further studies could be done to re-assess experiences of uncertainty among specific doctor subgroups after implementation of recommendations to decrease uncertainty in family medicine.

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ORIGINAL ARTICLE

A survey of current practices in Management of Delirium in a Geriatric population

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Purposes

The main purpose of the survey is to explore doctors' awareness of delirium and their experience in the management of this condition among older adults within the Department of Geriatric Medicine in Malta.

Methodology

An online questionnaire was distributed via electronic mail to all doctors working within the mentioned department between 18th October 2021 and 16th January 2022.

Results

Twenty-six participants (44.8%) answered the questionnaire, with the more responses received from the senior members of the Geriatric department. Twenty- four participants (92.4%) admitted that they commonly encounter delirium, with mixed delirium being the commonest type. Infection, change in environment, urinary retention, constipation, medication use and metabolic reasons were the most commonly identified reasons for delirium. Despite having a vast majority routinely screen for delirium, all participants admitted that there is a need for more awareness about it. Only twelve participants (46.2%) knew about the local guideline about delirium, despite it being published on the local hospital network in 2020.

Conclusion

This study shows that doctors working within the department of Geriatric Medicine in Malta appreciate the importance of timely management of delirium. However more education and awareness about the local guideline is necessary.

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Delirium is defined as a transient, commonly reversible, cause of fluctuations in mental function. This can occur at any age, but most commonly occurs in older adults or in those with pre-existing mental health issues..[1]

The Diagnostic and Statistical Manual of Mental Disorders Fifth Edition (DSM-5) defines delirium as fluctuating disturbance in attention and awareness which occurs over a short period of time, generally over a few hours to days. The change in cognition should not be explained by a pre-existing, established or evolving dementia. For delirium to occur there should be evidence from the history, physical examination, or laboratory findings that the disturbance is caused by a direct physiologic consequence of a general medical condition, an intoxicating substance, medication use, or more than one cause.[2] Management of delirium is dependent on the underlying organic cause of delirium. There are different types of delirium mainly hyperactive, hypoactive and mixed types.

Some of the assessment methods used to identify delirium include the Confusion Assessment Method (CAM), Confusion Assessment Method for the Intensive Care Unit (CAM-ICU), Intensive Care Delirium Screening Checklist (ICDSC) [3] and 4 'A's Test (4AT) screening tool [3]

The main aim of this study was to investigate current practices in the detection, investigation and management of older adults with delirium. This is of utmost importance because delirium is under recognised among older adults, leading to serious adverse health outcomes and death at times.[3]

METHODOLOGY

Approval was obtained from the research committees of Karin Grech Hospital (KGH) and Saint Vincent de Paul long term facility (SVP). An electronic survey was distributed to all foundation doctors, basic specialist trainees, higher specialist trainees, resident specialists, general practitioners and consultants working within the Department of Geriatric Medicine between 18th October 2021 and 16th January 2022. It included doctors working at KGH, SVP, orthogeriatric section at Mater Dei Hospital (MDH) and community. A total of 58 doctors were invited to participate. A second reminder was sent via electronic mail after three weeks.

The questionnaire was developed by the researchers based international literature as well as keeping in mind the local scenario. There were seventeen questions in all, some being close ended, while others allowed further comments from the participants.

RESULTS

Fifty-eight doctors working within the Geriatric Medicine Department were asked to participate in the survey. Twenty-six doctors (44.8%) replied with the majority of whom ten (38.5%) were consultants and nine (34.6%) were higher specialist trainees. Unfortunately only one (3.8%) basic specialist trainee and two (7.7%) foundation doctors gave their input.

Twenty-four participants (41.4%) declared their work place as shown in **Table 1**. The majority work in KGH and SVP

Table 1:Doctors' places of work

Twenty-nine (50%) participants had more than 10 years' experience as a medical doctor and twenty (34.6%) had been working for 6-10 years. Only one (1.7%) respondent had been working for 1-2 years.

Over fifty-two (90%) respondents admitted that they encounter delirium frequently or on a daily basis. This reflects the extent of the challenges delirium presents especially in the geriatric setting.

Mixed delirium was the commonest type of delirium encountered by the respondents with fourteen (53.8%) giving this answer. Nine (34.6%) participants stated that they most frequently encounter hyperactive delirium, with three (11.5%) stating that they commonly meet hypoactive delirium. This might reflect the fact that it is more difficult to pick up issues when a patient is more "quiet" than usual. Relatives or care-givers who know the patient well will easily identify "hypoactivity", but this is more difficult to be picked up by others.

Table 1 *Doctors' places of work*

Place of Work	Number of participants
KGH	20
SVP	6
Community	3
MDH	1
KGH & SVP	1
KGH & MDH	2
KGH, MDH, SVP & community	1

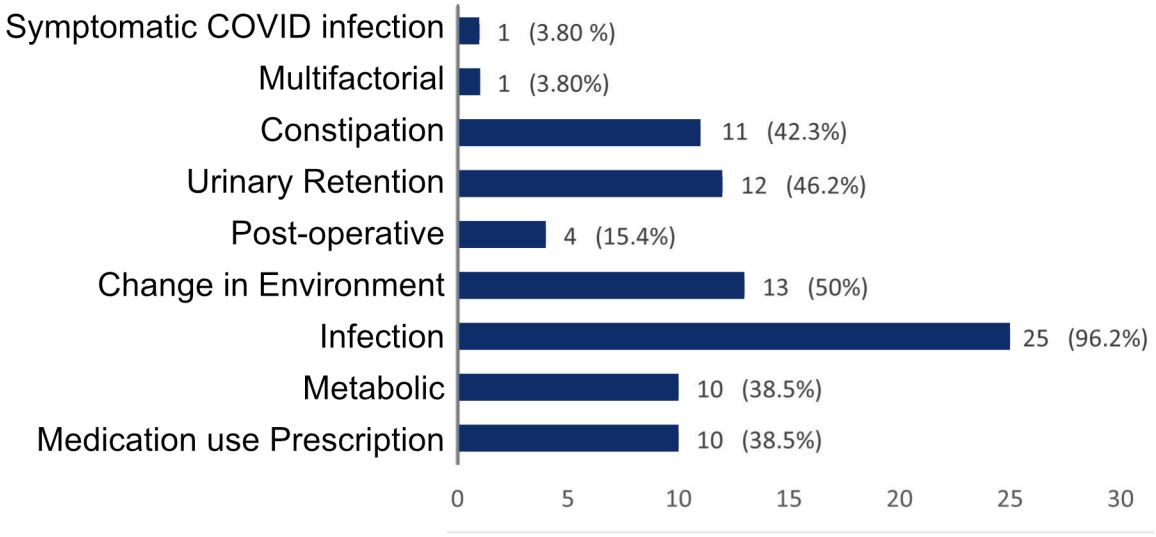

Figure 1 *Commonest causes of delirium*

Over forty-six (80%) respondents admitted that they frequently or always screen for delirium in older adults. Just over thirty-two participants (55%) claim that the inter-disciplinary team is primed to detect delirium.

Figure 1 shows the commonest reasons for delirium, while drug classes which were mostly associated with delirium are shown in **Figure 2**.

Seventeen (65.4%) participants admitted that they frequently encounter problems with drug prescription, with six (23.1%) claiming that they rarely encounter this issue. Furthermore nineteen (73.1%) state that they frequently notice issues with drug administration.

When it comes to environmental issues, unfamiliar place was named by fifty-three (88.5%) and chaotic environments by thirty-eight (65.4%) participants as being the main players which contribute to delirium. Lack of clock in the surrounding and lighting were mentioned to a much lesser extent, them being highlighted by eleven (19.2%) and twenty (34.6%) respectively.

4AT was used by twelve (46.1%) of the participants. Eight (30.8%) participants claimed that they used the Confusion Assessment Method (CAM). Five (19.2%) used orientation to time, place and person, while one (3.8%) participant claimed they used clinical examination, and another one (3.8%) used bloods

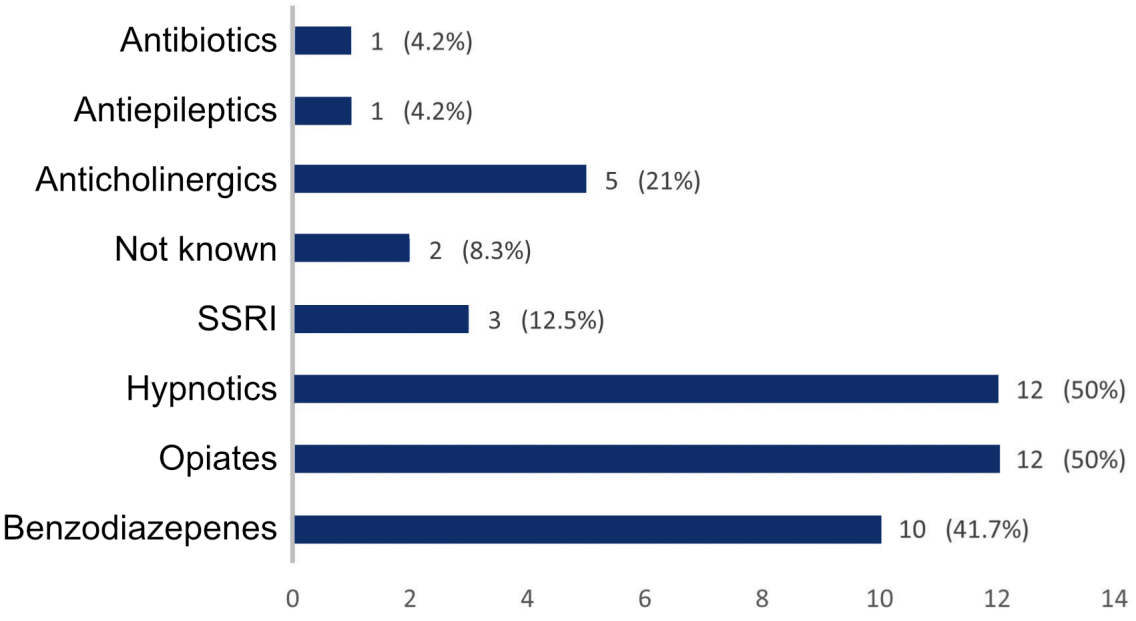

Figure 2 *Drugs commonly associated with delirium*

and parameters mostly. One of the participants did not reply to this question.

Only twelve (20%) knew about the local guideline for delirium. Ten (83.3%) of those knowing about the guideline found it useful.

The respondents agreed that there needs to be more awareness about delirium. When asked what could be done to enhance this, over forty-six (80%) believed that educational activities would help. Thirty-eight (65.4%) claimed that staff education would enhance reporting patient behaviour changes to professional staff such as nurses and doctors. This would allow safer and more timely managements of patients in delirium.

DISCUSSION

This study had a response rate of 44.8% which is deemed acceptable compared to usual response rates among medical doctors. International literature quotes 35% as an average response rate for most online surveys among doctors.[4]

The greatest strength of this study was that it the first such local study exploring the management of delirium in Malta. International research about this topic is also limited. In 2009, a group of researchers investigated the barriers to the management of delirium among junior doctors. It was clear that more awareness and education was required among these doctors.[5] The first Italian multicentre study about the management of delirium was published in 2014. This study included nurses, physiotherapists, psychologists apart from medical doctors.[6]

Whereas studies abroad show that CAM is the commonest used tool for the detection of delirium, it seems that the 4AT (4-abbreviated mental test) is more commonly used in the Geriatric department in Malta. In fact, 46.1% used 4AT versus 30.8% who used CAM The CAM tool is based on the four core features of delirium and has a high sensitivity (94-100%) and specificity (90-95%). The 4AT tests knowledge about age, date of birth, place and year. A score of three of less would indicate a problem with cognition.[7] Reasons for which 4AT is more commonly used in Malta need to be studied.

This first local study investigated the types of delirium the participants most commonly encountered and the commonest causes of delirium mostly identified by them. This had not been published in foreign studies. On the other hand, just like other published studies, this local study surely highlights the lacunae present in the teaching of the more junior staff about delirium. All the respondents felt that there need to be more awareness about delirium. This is also in light of the fact that 53.8% of doctors working within the Geriatric Department in Malta were not aware of a local guideline which had been published in 2020 on the local hospital intranet.

Just like foreign research, it is clear that there should be more education and awareness about delirium among doctors and other healthcare professionals.[8] Ideally there should be more promotion of local available material such as delirium guideline and leaflets. These results are also seen in international literature.[5,6]

The limitation of this study is that only doctors were invited to participate in the study. Should the study have included other healthcare professionals, the results would have been more robust. Ultimately all members of the interdisciplinary team are involved in the management of delirium with carers and nurses being at forefront in the detection of possible cues for delirium.

CONCLUSION

In conclusion, the results obtained in this survey reflect the need for more education among doctors for timely detection and management of delirium. Ideally there should be more promotion of local available material such as delirium guideline and leaflets. These results are also seen in international literature.[5,6] Another study about the management of delirium among other members of the interdisciplinary team would add more knowledge about the current situation in Malta.

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ORIGINAL ARTICLE

Predictive Factors Of Pyonephrosis In Renal Calculus Patients

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Background

This is a retrospective study conducted to describe the prevalence and analyse the predictive factors of patients with underlying renal calculi presenting with pyonephrosis in Hospital Universiti Sains Malaysia.

Methods

Patients with renal calculus disease with or without pyonephrosis presenting to Hospital Universiti Sains Malaysia between January 2009 and October 2020 were evaluated. Analysis of the data was done using both univariate and multivariate analysis.

Results

The prevalence of pyonephrosis from 1st January 2009 to 31st October 2020 was 120 of which 100 (83.3%) were secondary to renal calculus. A total of 139 renal calculus patients were included with 72 renal calculus patients without pyonephrosis and 67 renal calculus patients with pyonephrosis. The positive predictive factors amongst patients with renal calculus for developing pyonephrosis include diabetes mellitus (p = 0.038), non-functioning kidney (p = 0.022), staghorn calculi (p = 0.046) and moderate or severe hydronephrosis (p = 0.013). In terms of long term outcomes, 3.1% (2/65) patients passed away from urosepsis secondary to pyonephrosis and 12.3% (8/65) developed acute kidney injury (AKI) and progressed to chronic kidney disease (CKD).

Conclusion

Our study demonstrates out of a total of 338 patients who presented to HUSM with renal calculus, a prevalence of 120 patients (35.5%) across 11 years for pyonephrosis out of which 100 patients (83.3%) were renal calculus patients who developed pyonephrosis. Factors showing statistically significant associations with the development of pyonephrosis include diabetes mellitus (p = 0.024), non-functioning kidney on admission (p = 0.02), presence of staghorn calculi (p = 0.043) and moderate or severe hydronephrosis (p = 0.013).

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Pyonephrosis is the suppurative destruction of the renal parenchyma as a result of renal or ureteric obstruction. The causes of the obstruction can be intraluminal such as stones, or extraluminal such as compression from tumours. Pyonephrosis is a serious condition. However since it is uncommon, there is limited data in the literature regarding its prevalence. At the time of presentation, patients are usually ill and can end up with urosepsis, which comes with a mortality rate between 22% and 76%.[1] Consequently patients may require Intensive Care Unit admission. This may be accompanied by concomitant acute kidney injury secondary to obstruction. Therefore prompt treatment is essential to prevent damage to the renal parenchyma.

Pyonephrosis is caused by the obstruction of the ureter. The most common cause of pyonephrosis is renal calculus. In a study by Scarneciu et al, they found that 53 out of 65 cases (81.5%) of pyonephrosis were caused by renal calculus, and only 6 cases due to urological malignancy.[2] Pyonephrosis is an uncommon disease. In a study by Patodia et al on predictive factors for pyonephrosis, out of 501 patients with renal calculus disease, 91 patients (18.1%) developed pyonephrosis.[3]

Understanding the risk factors of a disease is critical, as this allows for stratification of patients to determine who is at considerable risk, allowing these patients to be counselled about their increased risk and be channelled into prompt treatment pathways. However there is not much data regarding the risk factors for pyonephrosis. Currently the only study performed is by Patodia et al They analysed retrospectively 501 patients with renal calculus disease (RCD) who required surgical intervention. They divided the patients into 2 groups: RCD patients without pyonephrosis (Group 1) including 410 patients and RCD patients with pyonephrosis (Group 2) with 91 patients. They identified that having the following features resulted in a higher risk for patients with RCD to develop pyonephrosis: a longer duration of symptoms, having a non-functioning kidney, multiple renal calculi, staghorn calculi, ureteric stones, hydronephrosis and previous kidney surgery.[3]

Previous data suggested that retrograde stent insertion was associated with an increased risk of infection and hence percutaneous drainage with nephrostomy was favoured instead.[4] However more recent studies have demonstrated equal outcomes for both.[5] The latest guidelines on management of pyonephrosis by the European Association of Urology and the American Urological Association state that percutaneous drainage or retrograde stent insertion are equally effective as first-line management. The choice between the two should be guided by local resources.[6,7]

Currently in our hospital, patients with pyonephrosis undergo retrograde pyelogram and stenting as the first therapeutic intervention. This strategy results in fewer complications in comparison to more invasive procedures such as percutaneous drainage which predispose the patient to bleeding (given that the kidney is a highly vascular organ) and seeding of bacteria into the peritoneum during the puncture procedure.[8] Our practice is consistent a 15-year retrospective study by Goldsmith et alwho found that Patients treated with percutaneous nephrostomy were more likely to require ICU admission and demonstrated longer length of hospital stay, even when adjusting for age, APACHE II score, and Charlson Comorbidity Index score.[9] (If retrograde stenting has failed due to inability to pass the stent through the blocked ureter, nephrostomy is then considered the next step and performed by interventional radiology.

Most studies published on the treatment of pyonephrosis are primarily based on percutaneous drainage. However in our centre, we practice drainage via retrograde stent insertion. So far, despite guidelines, data regarding retrograde ureteric stent in treatment for pyonephrosis and their outcome worldwide and in Malaysia remains underreported.

At the Indira Gandhi Medical College where cystoscopy is not always available, Sood et al have performed a study on the performance of percutaneous nephrostomy in 50 kidneys on 32 patients with pyonephrosis. The success rate of their procedure was 42 out of 50 patients (84%). Outcome-wise they noted that the most common complication of percutaneous nephrostomy, which is bleeding, presented as haematuria in 14% of cases.[10] They concluded that percutaneous nephrostomy is a suitable alternative for drainage.

Flukes et al performed a prospective study of 53 patients over a 15 months' period from January 2012 to April 2013. Their primary objective was to review the outcome of patients undertaking retrograde ureteric stenting for pyonephrosis. In their study, they demonstrated that 51 of 52 patients (98%) were successfully treated with retrograde ureteric stenting. A theoretical risk of retrograde stenting is the worsening of sepsis secondary to instrumentation. In their study, only 3 patients required ICU admission.

The European Association of Urology currently advocates either percutaneous nephrostomy or retrograde ureteric stenting for drainage of pyonephrosis.[7]

Currently there is no data available regarding the prevalence of patients suffering from pyonephrosis in Malaysia. There are also no defined predictive factors that can stratify and identify at-risk patients for pyonephrosis in renal calculus patients. Renal calculus patients are treated on an elective basis with some patients postponing (or treatment being delayed) treatment for years. Early identification of these high-risk patients can lead to channelling of these patients into earlier treatment pathways to treat their causative factors pre-emptively, thereby preventing the patient from developing this complication, which is associated with a substantial risk of morbidity and mortality. Early intervention can be done to improve the patients' overall outcomes.

In a retrospective study, Patodia et al noted that longer duration of symptoms, staghorn calculi, hydronephrosis, ureteric stone, multiple renal stone, non-functioning kidney, and previous kidney surgery were predictors for pyonephrosis.[3] Yongzhi et al also found other risk factors associated with acute renal infections in patients with calculus disease including female gender, older age, and multiple sites of stone.[11] We intend to analyse the predictive factors in our population as well as assessing other relevant predictive factors.

The data obtained during this study includes outcomes of patient with pyonephrosis. By obtaining data regarding outcomes for pyonephrosis, we aim to provide more accurate counselling to patients regarding the risk of this disease to their health, so that they can reach a better decision regarding the further management of their disease.

MATERIALS AND METHODS

This is a retrospective review of medical records in Hospital Universiti Sains Malaysia (HUSM) Kelantan Malaysia from 1st January 2009 to 31st October 2020. Depending on risk factors, renal calculus patients can present as renal colic, hydronephrosis or pyonephrosis. We aim to identify and determine the predictive factors for renal calculus patients to develop pyonephrosis. We therefore allocated those presenting as renal colic and hydronephrosis as our comparator group. The study population are the patients with renal calculus disease who presented at HUSM

Simple random sampling will be used to select patients with renal calculus disease without pyonephrosis (Group 1). All renal calculus patients who presented with pyonephrosis will be included (Group 2). The diagnosis of the patient will be taken from the formal ultrasound or CT (Computed Tomography) imaging report and from intraoperative findings. Inclusion criteria were patients with renal calculus disease who presented to HUSM between January 2009 and October 2020 and patients diagnosed with pyonephrosis over the last 10 years. Exclusion criteria were missing patient notes and patients who did not attend follow-up.

Statistical Data Analysis

Data was analysed with Statistical Package for the Social Sciences (SPSS) version 26.

Descriptive analysis was used to summarise the socio-demographic characteristics of subjects. Numerical data was presented as mean (SD) or median (IQR) based on their normality distribution. Categorical data was presented as frequency (percentage).

Independent t test was used to compare continuous data and chi-square test was used to analyse categorical data. The statistical significance level used was $p < 0.05$. Data for risk factors were analysed with simple logistic and multivariate binary logistic regression to identify the predictors for pyonephrosis.

RESULTS

Out of a total of 338 patients who presented to HUSM with renal calculus from 1st January 2009 to 31st October 2020, 120 cases (35.5%) presented with pyonephrosis. 83.3% (100/120) of these were secondary to renal calculus, while 16.7% (20/120) were due to other causes. Of these 20 cases, there were 4 cases due to gynaecological cancer, 2 cases each of duplex kidney, ureteric cancer, ureteric stricture, neurogenic bladder and colon cancer, and 1 case each of bladder cancer, renal cancer, renal abscess, uterine fibroid, pregnancy and retroperitoneal cancer.

139 renal calculus patients were included in this study, with 72 patients in Group 1 (calculus disease without pyonephrosis) and 67 patients in Group 2 (calculus disease with pyonephrosis). The findings of the patient-related and disease-related factors from both groups are detailed in Table 1 and Table 2 respectively. A p value less than 0.05 was considered statistically significant for the univariate analyses.

Table 1 *Results of data collection for patient-related factors*

Variable	Group 1 (n = 72)	Group 2 (n = 67)	p value
Demographics			
Age (years) Mean ± Standard Deviation, Range	52.50 ± 13.95 23 - 84	56.66 ± 14.15 19 - 90	0.79
Sex (Male / Female)	42/30	22/45	*0.003*
Sex Ratio	1.4 : 1	1 : 2.05	
Race (Malay / Chinese)	69/3	65/2	1.000
Associated co-morbidities			
Past history of urinary tract infections	0	23	*< 0.001*
Gynaecological cancer	2	2	0.94
Diabetes mellitus	16	36	*< 0.001*
Chronic kidney disease	6	26	*< 0.001*
Non-functioning kidney on admission	3	25	*< 0.001*
Gout	2	3	0.67
Anatomic variations of kidney	0	6	*0.011*
Previous urological intervention	10	31	*< 0.001*

Variants which could be potential predictive factors from Table 1 and Table 2 and showed univariate significance were subsequently entered into a multivariate logistic regression model. These factors are shown in Table 3. A p value less than 0.05 was considered statistically significant for the multivariate analysis.

From the logistic multivariate analysis, factors shown to have statistically significant associations with pyonephrosis were diabetes mellitus (p = 0.038), non-functioning kidney on admission (p = 0.022), presence of staghorn calculi (p = 0.046) and presence of moderate or severe hydronephrosis (p = 0.013). Variables which showed univariate significance but were not statistically significant during multivariate analysis included: sex, history of urinary tract infections, chronic kidney disease, anatomic variations of kidney, previous urological intervention, positive urine culture for bacteremia, number of calculi and large size of renal calculi.

DISCUSSION

The prevalence of pyonephrosis across from January 2009 to October 2020 was 120. 83.3% (100/120) of these were secondary to renal calculus, while 16.7% (20/120) were due to other causes. At the time of writing, there is limited evidence in the literature regarding prevalence of pyonephrosis due to the scarcity of cases.

According to Patodia et al, there was no statistically significant difference between the number of male and female patients with renal calculus presenting with pyonephrosis. With regards to age, there was also no significant discrepancy between renal calculi patients with pyonephrosis compared to their counterparts without pyonephrosis.[3] This is consistent with the findings in our own study.

In our study, 96.4% (134/139) of the patients over both groups were Malay with the remaining 5 patients (3.6%) being Chinese. Our study is therefore most representative of the Malay population, however further studies would be required to explore the predictive factors for pyonephrosis in renal calculi patients of Chinese background.

Pyonephrosis can present with a number of symptoms, the most frequent symptoms of which are fever, rigors and lumbar pain.[12] In one study, lumbar pain was noted to occur in 70% of patients with pyonephrosis, with fever, rigors and pyuria present in all their cases.[13] Renal angle tenderness can indicate

Table 2 *Results of data collection for disease-related factors*

Variable	Group 1 (n = 72)	Group 2 (n = 67)	p value
Clinical presentation			
Lumbar pain	55	44	0.163
Radiation of pain to groin	19	21	0.519
Cloudy urine	3	11	*0.016*
Pyuria	0	17	*< 0.001*
Urinary frequency	15	18	0.40
Haematuria	16	7	0.062
Fever	11	51	*< 0.001*
Dysuria	15	22	0.11
Rigors	4	26	*< 0.001*
Renal angle tenderness	6	39	*< 0.001*
Biochemical Abnormalities			
Elevated uric acid	37	34	0.458
Elevated potassium	9	10	0.804
Elevated blood urea nitrogen	19	31	*0.027*
Elevated creatinine	24	38	*0.015*
Elevated white cell count (> 12 x 10^6)	13	36	0.141
Positive urine culture for bacteraemia			
No growth	64	44	
Escherichia coli	4	6	
Klebsiella pneumoniae	2	4	
Extended Spectrum Beta Lactamase	1	9	*0.004*
Candida	1	2	
Acinetobacter	0	1	
Serratia marcescens	0	1	
Imaging Findings			
Number of calculi (single / multiple)	40/32	25/42	*0.031*
Size of calculi > 2 cm	11	21	*0.014*
Staghorn calculi present	7	23	*< 0.001*
Number of renal calices involved (0/1/2/3)	35/28/8/1	30/25/10/2	0.818
Lower calyx involvement	29	26	0.859
Grade of hydronephrosis			
None or mild	44 (61.1%)	22 (32.8%)	*0.001*
Moderate or severe	28 (38.9%)	45 (67.2%)	*0.001*

Table 3 *Variables used for logistic multivariate regression*

Model	x^2 statistics (df)	Sig. p value
(Constant)	0.000 (1)	0.997
Sex	0.418 (1)	0.518
Past history of urinary tract infections	0.000 (1)	0.997
Diabetes mellitus	5.131 (1)	0.024
Chronic kidney disease	0.745 (1)	0.388
Non-functioning kidney on admission	5.396 (1)	0.020
Anatomic variations of kidney	0.000 (1)	0.999
Previous urological intervention	1.269 (1)	0.260
Positive urine culture for bacteraemia	2.163(1)	0.141
Number of calculi	2.310 (1)	0.129
Size of calculi > 2 cm	0.759 (1)	0.384
Staghorn calculi present	4.108 (1)	*0.043*
Grade of hydronephrosis	6.143 (1)	*0.013*

Dependent variable: Development of pyonephrosis
Adjusted R square – 0.700

pyelonephritis or presence of renal calculi, the latter of which can entail pyonephrosis. The literature regarding other potential symptoms remains otherwise limited. It is to be noted that, while seen very often in pyonephrosis, pyuria can be a non-specific finding.[12]

Several other studies have explored the effects of co-morbidities in pyonephrosis. Up to 20% of patients suffering from gout go on to develop nephrolithiasis, which can then in turn precipitate pyonephrosis.[14] Poorly-controlled diabetes mellitus, non-functioning kidney and anatomic variations of the kidney such as pelvic kidney or horseshoe kidney were noted to be risk factors for pyonephrosis[3,12,15]. In addition, an important cause of pyonephrosis is obstruction, which can be accounted for by urinary tract infections, metastatic tumours and as a post-operative complication of previous urological surgery.[12] There is currently limited literature on how chronic kidney disease is related to pyonephrosis. Our study showed that, of the co-morbidities, only diabetes mellitus and non-functioning kidney on admission showed statistically significant associations with pyonephrosis. History of urinary tract infections did not prove to be statistically significant on multivariate analysis. We suspect this may because urinary tract infections mainly affect the lower urinary tract.

Raised uric acid levels are a notable feature of gout, of which up to 20% of patients eventually develop nephrolithiasis, which itself is implicated in the pathophysiology of pyonephrosis. In addition, while not directly markers of kidney function, potassium is often affected in kidney disease.[14] Leucocytosis may be a feature of pyonephrosis, however a study by Erol et al proposes that leucocytosis is one of the signs which may not be present in up to 30% of cases.[12] In our study, none of these biochemical markers showed statistically significant associations with pyonephrosis.

Gram-negative bacilli account for most suppurative bacterial infections affecting the urinary tract, with E coli being the most common isolated pathogen in pyonephrosis.[16,17] Other infectious causes of pyonephrosis include fungal infections and tuberculosis. In addition, a study by Picozzi et al demonstrated Extended-Spectrum Beta-Lactamase (ESBL) producing E coli as accounting for 14.3% (7/49) of patients admitted for upper urinary tract infections, with all 7 of these patients developing pyonephrosis and sepsis.[18]

Similar findings were noted in our study, including how most cases with positive urine cultures for bacteraemia showed gram-negative bacilli – including Escherichia coli and Klebsiella Pneumoniae – as well as how most cases of ESBL affected the pyonephrosis group. Compared to the non-pyonephrosis group, the pyonephrosis group had the most cases of bacteraemia caused by atypical microorganisms resistant to antibiotics including ESBL, a case of Ampicillin-C-beta-lactamase-producing Klebsiella pneumoniae, and the gram-negative bacilli Acinetobacter and Serratia marcescens. However while positive urine culture for bacteraemia showed univariate significance, it was not found to show a statistically significant association with pyonephrosis on multivariate analysis in our study.

Of the obstructive causes leading to pyonephrosis, renal calculi play an important part with up to 75% of these stones being staghorn calculi.[12] In addition, Patodia et al found that staghorn calculi, as well as the number – but not the size – of renal calculi, were statistically significant in renal calculi patients with pyonephrosis compared to renal calculi patients without pyonephrosis on logistic multivariate analysis.[3] In our own study, staghorn calculi, the number, and the size of renal calculi each showed univariate significance with pyonephrosis. This is likely due to large stones and multiple calculi causing urinary retention and damaging renal parenchyma. Of these factors, however, only staghorn calculi was noted to be statistically significant on multivariate analysis in our study.

The location of the renal stone within the calyx of the kidney holds important clinical significance in and of itself. Management of calculi in the lower pole of the kidney have been found to be particularly challenging both with extracorporeal shock wave lithotripsy and retrograde intra-renal surgery compared to the upper or middle poles of the kidney.[19] Based on our study, however, neither lower calyx involvement nor involvement of multiple renal calyces demonstrated any statistically significant association with pyonephrosis.

The severity of hydronephrosis was noted to be a predictor of pyonephrosis in our study. This is consistent with the findings of Patodia et al[3], who also demonstrated that patients with pyonephrosis tended to have a more severe hydronephrosis, as well as by Boeri et al[3], who identified the severity of hydronephrosis as being an independent predicting factor for pyonephrosis.

In terms of management, out of 67 pyonephrosis patients, 30 had retrograde stenting, 29 had antegrade stenting with nephrostomy and 2 patients had antegrade stenting following failed retrograde stenting. 4 patients were treated conservatively due being unfit for operation. They were treated with high dose antibiotics and 2 patients presented too late and passed away.

The indications for nephrostomy as intervention instead of retrograde ureteric stenting in HUSM included patient not being fit for retrograde pyelography and stenting, failed retrograde ureteric stenting due to technical issues or lack of available expertise.

In terms of complications post procedure, out of 61 patients who underwent intervention included sepsis in 14.8% (9/61) patients, perforation in 2 cases, and gross haematuria in 3 cases.

SUMMARY BOX

What is already known about this subject:

- Pyonephrosis is associated with high mortality
- Currently there is limited data on prevalence of pyonephrosis
- There is also limited data on predictive risk factors for pyonephrosis

What are the new findings:

- Our study demonstrates a prevalence of 120 patients across 11 years for pyonephrosis out of which 100 patients (83.3%) were renal calculus patients who developed pyonephrosis.
- We have also identified several factors showing statistically significant associations with the development of pyonephrosis. These include diabetes mellitus ($p = 0.024$), non-functioning kidney on admission ($p = 0.020$), presence of staghorn calculi ($p = 0.043$) and moderate or severe hydronephrosis ($p = 0.013$).
- In terms of complications post procedure, out of 61 patients who underwent intervention included sepsis in 14.8% (9/61) patients, perforation in 2 cases, and gross haematuria in 3 cases.
- In terms of long-term outcome, 2 patients died from urosepsis secondary to pyonephrosis, 66.1% (43/65) patients had acute kidney on acute presentation (AKI) which resolved, and 12.3% (8/65) developed AKI and progressed to chronic kidney disease (CKD). 24.6% (16/65) did not have AKI.

Post intervention, symptoms improved within 24 hours for 54.1% (33/61) patients, within 48hrs for 26.2% (16/61) patients and only 13.1% (8/61) took more than 48hrs.

In terms of long-term outcome, 2 patients died from urosepsis secondary to pyonephrosis, 66.1% (43/65) patients had acute kidney on acute presentation (AKI) which resolved, and 12.3% (8/65) developed AKI and progressed to chronic kidney disease (CKD). 24.6% (16/65) did not have AKI.

CONCLUSION

Our study demonstrates a prevalence of 120 patients (35.5%) across 11 years for pyonephrosis out of which 100 patients (83.3%) were renal calculus patients who developed pyonephrosis. We have also identified several factors showing statistically significant associations with the development of pyonephrosis. These include diabetes mellitus, non-functioning kidney on admission, presence of staghorn calculi and moderate or severe hydronephrosis. Other factors which demonstrated statistical significance on univariate analysis but not on multivariate analysis include sex, history of urinary tract infections, chronic kidney disease, anatomic variations of kidney, previous urological intervention, positive urine culture for bacteremia, number of calculi and large size of renal calculi. In terms of long-term outcome, 3.1% (2/65) patients passed away from urosepsis secondary to pyonephrosis and 12.3% (8/65) developed AKI and progressed to chronic kidney disease (CKD).

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ORIGINAL ARTICLE

Knowledge and Practices of Nurses on Prevention of Nosocomial Infection in Emergency Care Hospitals

Tengiz Verulava

Objective

Developing countries such as Georgia, face up to Nosocomial infections (Nis) which is a key problem of healthcare system. The main reason for reducing relevance to this practice is the lack of knowledge about infection control practices among healthcare workers. While nurses play a unique role in the hospital infection control processes, the goal of the study is to assess the knowledge and practices of nurses regarding NIs in emergency care hospitals.

Method

Descriptive, cross-sectional study was conducted. A total of 150 nurses were enrolled through randomized simple selection.

Results

Most of the nurses had a sufficient level of knowledge about NIs, but their practices to reduce the spread of infection were not up to a satisfactory level. There was a significant relationship between knowledge and practices, which include attending NIs training courses and practices to gain professional experience ($p<0,05$). Though, only 53.7% of interviewed nurses consider that they barely take into account the recommendations about reducing NIs. Also, only 54.5% nurses do hand hygiene activities after contacting subjects around the patient. However, there is no significant statistical connection between the knowledge about principles of hand hygiene and demographic indicators of nurses.

Conclusion

Having adequate education and practice in Nis control and prevention is a must for healthcare workers. The majority of the nurses has sufficient knowledge and practice about NIs control measures. However, possessing adequate knowledge is ineffectual until the proper application of infection control practices. Nurses need further improvement through the regular educational programs.

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Nosocomial infections (NIs) are the type of infections that are acquired in the health care facility within 48 hours of admission. NIs associated with antimicrobial resistance increase patients' morbidity, mortality, length of hospital stay, and treatment cost.[1] The major risk factors for nosocomial infections are prolonged and irrelevant usage of medical items and antibiotics, improper usage of standards and isolation procedures, inadequate environmental hygiene and waste management, lack of education about the infections, safe injection, and blood transfusion.[2] According to WHO, approximately 15.0% of hospitalized patients acquire nosocomial infections (NIs).[3] Incidence of the NIs in the high-income countries ranges from 3.5% to 12.0%, in the middle- and low-income countries – from 5.7% to 19.1%[4] and about 15.0% to 40.0% of the patients are in critical care units.[5] The frequency of infection transmission in low-income countries is three times more than in high-income countries.[6]

Approximately 44% of infections are related to the usage of invasive medical items, and 2/3 of them are caused by intravenous medical devices like peripheral and central venous catheters.[7] The highest rate of the NIs is recorded in intensive and surgical care units, with a rate of 5.6 cases in every 100 patients.[8] The risks of NIs increase when standard hygienic guidelines are ignored.[9,10] The most influential factors in the prevention of NIs are the knowledge and practices of the nurses.[11] The goal of the study is to assess the knowledge and practices of nurses about NIs in emergency care hospitals in Tbilisi (Georgia).

MATERIAL AND METHODS

A descriptive, cross-sectional study was conducted in four large emergency care settings in Tbilisi Georgia. One facility was an emergency hospital, while the other three were the emergency departments of general hospitals. Three were private medical institutions and one was run by the state. The number of beds varied from 180–600, while the number of staff employed ranged from 350–500. The study was conducted between January and July 2022.

Data were collected using a self-administered questionnaire, developed by Kamunge et al[12] The questionnaire was piloted with 15 nurses before the launch of the main study and some changes were made to the wording to better accomodate the local culture and environment. The first part of the questionnaire asked participants about their demographic characteristics and training, including age, sex, education, employment status, job role, participation in infection control training sessions and workshops, and experience in infection control. The second part contained questions about healthcare-associated infection transmission and effective management. The third part examined infection control measures practised by participants, such as hand hygiene, disinfection and safe injections practice.

A 5-point Likert scale was used ('completely disagree', 'disagree', 'cannot answer', 'agree', 'completely agree'). Results were analysed using the Statistical Package for the Social Sciences version 20. Associations between participant variables and knowledge of healthcare-associated infection prevention and management were assessed using a Chisquare test, with $P<0.05$ indicating statistical significance.

A total of 150 nurses working across the four centres were invited to participate in this study through randomised (targeted) simple selection. This method of sampling enabled the study population to have an equal and independent chance of appearing in the study sample. To be eligible to participate in the study, nurses had to have at least 1 year of experience. A total of 150 questionnaires were distributed via email, of which 134 were completed, giving an 89% response rate. The sample size for this study was selected in consultation with head nurses from selected medical organisations.

The study protocol was granted ethical approval by the Bioethics Committee of the Caucasus University (No 2022–35) in January 2022. Before participating in the study, all participants gave informed consent.

RESULTS

The absolute majority of the respondents were females (n=134; 100%). The demographic data of the respondents are shown in Table 1. The majority of the nurses (69.0%; n=92) had more than 5 years of employment experience in the hospital and 69.4% (n=93) of them had taken the NIs control training course at least once (Table 1).

Most of the nurses had sufficient level of knowledge about hand hygiene. More than two-thirds of the respondents confirmed, that in patients, who are placed in the intensive care unit, the most common means of transmitting infection are hands. (88.1%; n=118) and hand hygiene is necessary after

Table 1 *Distribution of respondents by the demographics (N= 134)*

Demographics	n (%)
Age (years)	
20 - 29	28 (20.9%)
30 – 39	56 (41.8%)
40-49	36 (26.9%)
50 – 59	12 (9.0%)
60	2 (1.5%)
Sex	
Female	134 (100.0%)
Male	0 (0.0%)
Level of education	
Certificate of Vocational Education received at Nursing Trainings	42 (31.0%)
University Bachelor's Degree in Nursing	92 (69.0%)
Hospital employment duration	
≤ 5	102 (76.0%)
> 5	32 (34.0%)
Number of trainings regarding the NIs control	
0	
1-5	41 (30.6%)
6-10	93 (69.4%)
10	0 (0.0%)

contacting the patient (86.6%). The most of the nurses (73.1%; n=118) agreed that the NIs may be transmitted through the medical equipment (Table 2). Most of the nurses know about the 5 principles (70.1%; n=94) and 6 steps (67.2%; n=90) of the hands hygiene provided by the World Health Organization. However relevantly small number of the respondents (38.1%; n=51) consider that hand washing or disinfection is necessary before each contact with the patient. Further details about knowledge of nurses regarding NIs transmission are presented in Table 2.

The most of the nurses had good practices on actual actions utilized to prevent NIs. The study suggested that 84.4% (n=113) of nurses follow recommendations about using the antiseptic solutions before and after the procedure. According to the respondents, the hospital periodically monitors the knowledge regarding infection prevention and control (70.9%; n=9). Tthe majority of nurses (71.6%; n=96) periodically attend the trainings/workshops in order to prevent and control the infections. However only 54.5% (n=73) do hands

Table 2 *Knowledge of nurses regarding NIs transmission*

	Question	Disagree	Can't answer	Agree
1	Hands are most spread mean for NIs transmission	2 (1.5%)	14 (10.4%)	118 (88.1%)
2	NIs may be transmitted by medical equipment like thermometers, syringes, catheters, stethoscopes?	13 (9.7%)	23 (17.2%)	98 (73.1%)
3	NIs are mostly caused by the bacteria brought in by the hospital staff?	23 (17.1%)	41 (30.6%)	70 (52.3%)
4	NIs is an infection that the patient developed whilst at home	11 (8.2%)	37 (27.6%)	86 (64.2%)
5	In case of limited beds, patients with communicable diseases may be placed in the same ward with other patients	109 (81.3%)	16 (11.9%)	9 (6.7%)
6	Infectious patients (e.g., with respiratory system infections) should be placed in separate boxed wards	13 (9.7%)	26 (19.4%)	95 (70.9%)
7	I know 5 principles of the hand hygiene provided by the WHO	23 (17.2%)	17 (12.7%)	94 (70.1%)
8	I know 6 steps of the hand hygiene provided by the WHO	25 (18.7%)	19 (14.2%)	90 (67.2%)
9	Hand hygiene is required before contact with the patient	37 (27.6%)	46 (34.3%)	51 (38.1%)
10	Hand hygiene is required after contact with the patient	6 (4.5%)	12 (9.0%)	116 (86.6%)
11	Hand hygiene is required after contact with patient's objects and items	17 (12.7%)	30 (22.4%)	87 (64.9%)
12	Hand hygiene should be performed after removing sterile or non-sterile gloves	12 (9.0%)	37 (27.6%)	85 (63.4%)

Table 3 *Knowledge of nurses regarding NIs transmission*

	Question	Disagree	Can't answer	Agree
1	I follow recommendations of using antiseptic solutions before and after the surgical interventions	3 (2.2%)	18 (13.4%)	113 (84.4%)
2	The hospital periodically monitors the knowledge of infection prevention and control	25 (18.7%)	14 (10.4%)	95 (70.9%)
3	I annually attend the trainings / workshops related to the infection prevention and control	15 (11.2%)	23 (17.2%)	96 (71.6%)
4	Personal protection equipment is always available	8 (6.0%)	19 (14.2%)	84 (79.9%)
5	I change gloves and perfrorm hand hygiene during the patient care process when moving from the contaminated area to the clean spot (mucous, damaged skin) or after contacting any item in the patient's environment (e.g. bed parts)	16 (11.9%)	20 (14.9%)	98 (73.1%)
6	I always clean my nails	4 (3.0%)	11 (8.2%)	119 (88.8%)
7	I consider the recommendations regarding the reduction of infections transmission less, when the workload increases or during the emergencies?	23 (19.4%)	36 (26.9%)	72 (53.7%)
8	I wash my hands after contacting the items in the patient's environment	23 (17.2%)	38 (28.4%)	73 (54.5%)
9	I remove rings, watch, bracelets before starting the hand hygiene	58 (43.3%)	27 (20.1%)	49 (36.6%)

hygiene after touching the items placed around the patients and only 36.6% (n=49) remove rings, watches, bracelets before the hands hygiene. Further details are given in Table 3.

There is no statistically significant correlation between knowledge of the hands hygiene and demographic characteristics like gender and level of education (p> 0,05). However there is a significant connection between the knowledge gained while attending NIs training courses and professional practice experience (p-value<0.05) (Table 4).

Statistical correlation between the knowledge regarding the NIs and the demographics of the nurses

DISCUSSION

According to the study results, the absolute majority of respondents were women, which confirms the fact that the nursing is predominantly women's profession.[13] In order to explain this case, cultural perspective is a key. For preventing infectious

Table 4 *Statistical correlation between the knowledge regarding the NIs and the demographics of the nurses*

Demographics	Knowledge of 5 principles of hand hygiene	p-value
	94 (70.1%)	
Age (years)		
20 - 29	22 (23.4%)	
30 – 39	36 (38.3%)	
40-49	27 (28.7%)	0.865
50 – 59	8 (8.5%)	
60	1 (1.1%)	
Sex		
Female	94 (100.0%)	0.813
Male		
Level of education		
Certificate of Vocational Education received at Nursing Trainings	28 (28.0%)	0.514
University Bachelor's Degree in Nursing	66 (56.0%)	
Hospital employment duration		
≤ 5	73 (77.7%)	*0.039*
> 5	21 (22.3%)	
Number of trainings regarding the infection control		
0		
1-5		*0.041*
6-10	32 (34.0%)	
10	62 (66.0%)	

diseases, strict compliance with the universal measures of safety is the most significant.[14] The study showed that the nurses are sufficiently aware of how to control NIs transmission. The majority of the nurses who participated in the study, knows the hands hygiene guidelines and are always ready to perform them after contacting the patient. Other studies also showed the similar results[15,16] However the results of this study are not consistent with the results of some other studies.[17,18]

Also the nurses have adequate knowledge about using the antiseptic solutions before and after nursing procedures. Likewise the study also revealed the adequate knowledge of the nurses regarding safety standards of using medical equipment. Other studies also showed the similar results.[19] However despite the guidelines, some studies showed that despite the guidelines, the rates of hands hygiene compliance are still so low.[20]

The high level of the knowledge, which has been revealed in the survey, is the possible result of frequent training courses regarding NIs. In this regards, the study proves that most of the nurses (69.4%) attended annual continuing education courses about infection control at least once. This result is compatible with other studies.[21] However such result are inconsistent with some other studies, which indicated that most of the nurses did nottake any training courses about NIs.[22] This contrast in results could be the result of the actual difference in in-service training-related policy.

It is also noteworthy that 27.6% (n=37) of the nurses disagree the necessity of the hand hygiene before contacting the patient, and 43.3% (n=58) don't agree with the protocol of removing rings, watches, bracelets before starting the hands hygiene, also, 19.4% (n=23) do not fully consider recommendations about reducing the infections transmission during increased workload or emergency situations. The mentioned facts show, that in order to stop the transmission of NIs and to ensure patients safety, high level of knowledge isn't sufficient. Regular monitoring, adequate development of human and material resources are essential.

The study showed that the experience was crucial for nurses to have the better level of knowledge. Our study results correspond with other studies proving that the more professional experience you have, the greater level of knowledge you gain.[23] This results could be due to the existing connection between theory and practice.

There is no statistically significant correlation between knowledge of the hands hygiene and demographic characteristics like gender and level of education (p> 0,05) corresponding with some other studies.[24] Significant statistical correlation exists (p<0,05) between knowledge of the hands hygiene and number of the training courses regarding NIs which is equivalent to other studies.[25] Also there was a significant relationship between knowledge and professional practice experience in the present study. This result is also analogous in other studies.[26]

LIMITATIONS

This study was conducted among a relatively low number of participants, given the size >of the nursing community in Georgia and worldwide. Therefore these results may not be >generalisable to other centres. The study also only assessed nurses' theoretical knowledge and so could not necessarily capture their practice. Future studies should assess nurses in the workplace, examining how closely they implement infection control measures, to shed more light on this area. Since the patients' medical records were not available, differentiating between infection, colonisation and contamination was not possible and associations between the pathogens, severity of infections and outcomes cannot be established.

CONCLUSION

Adequate education and good practice in healthcare-associated infection management and prevention is essential for healthcare workers. Although the majority of the nurses in this study had sufficient knowledge, attitudes and practices about healthcare-associated infection management measures, some recommendations were not always followed. This suggests that more regular education is needed on infection control to improve knowledge about the prevention and management of healthcare-associated infections, according to international standards. There is also an urgent need to establish infection management practices and comprehensive surveillance systems in medical organisations to maximise the quality of patient care. An organisational culture that focuses on infection control practices could reduce the incidence of healthcare-associated infections..

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CASE REPORT

A Case study of the breakdown of Sport skill Under Pressure Roberto Baggio's 1994 World Cup Final penalty

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This case study attempted to elucidate the psychological underpinnings behind a moment in time of Roberto Baggio's life. There are many theories which could explain Baggio's response to pressure at the moment he choked under pressure during the Italy vs Brazil 1994 World Cup where his final penalty of the tournament 'punched a hole in the sky'. The Biopsychosocial theory, neuroendocrine theory and the Theory of Challenge and Threat States in Athletes transactional theories were chosen given the years of consistent robust published research. The breakdown of the skill which led to the penalty shot going wide over the crossbar was described through the reinvestment theory; deautomization of skill which happens when attentional focus shifts from external to internal, due to the heavy demand on declarative memory. Rational Emotive Behavioral Therapy (REBT) was the chosen therapy for Baggio's hypothetical psychological intervention given the positive evidence it has over other psychotherapies and the role new Rational beliefs play in positively altering the perception of the player under stress.

https://www.youtube.com/watch?v=gTCCqqb6mSQ

The 1994 World Cup final, a historic event not just for Brazil's victory but also for Roberto Baggio's missed penalty in the shootout, serves as a poignant case for our study. Baggio a revered figure in Italian football, had been a driving force for his team throughout the tournament. However the intense pressure of the moment led to a rare miss, allowing Brazil to clinch the title. This outcome, while shocking, provides a compelling case for delving into the psychological factors that can disrupt even the most skilled athletes.

Baggio's reflection on the incident highlights his thought process: "As for the penalty, I knew Taffarel always dived, so I decided to shoot for the middle, about halfway up, so he couldn't get it with his feet. Unfortunately I do not know how the ball went up three meters and flew over the crossbar".[1] This case study applies various psychological theories to unpack the mechanisms that led to Baggio's breakdown under pressure.

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THEORETICAL FRAMEWORK

The biopsychosocial model provides an initial framework for understanding how physical, psychological, and social factors all contribute to performance outcomes in stressful situations.[2] In Baggio's case, these factors converged in the form of the high stakes of the World Cup final, fatigue from 120 minutes of play, and the expectations of an entire nation. The cognitive appraisal of this situation, in which Baggio likely assessed the penalty kick as a significant threat rather than a challenge, adds another layer to the analysis.

According to Lazarus and Folkman's theory of cognitive appraisal.[3], the way an individual perceives and reacts to stress depends on their evaluation of the demands of a situation versus their perceived ability to meet those demands. The Theory of Challenge and Threat States in Athletes (TCTSA) expands on this by focusing on how athletes respond physiologically and emotionally to competitive pressure [4] Baggio's situation likely induced a threat state, where his perception of the demands outstripped his resources to cope, leading to a physiological response characterized by increased cortisol levels and heightened vascular resistance.[5]

ANALYSIS

Several key factors likely contributed to Baggio experiencing a threat state rather than a challenge state. First the immense pressure of taking a penalty in the World Cup final would have weighed heavily on any player. This stress was exacerbated by Italy's position in the penalty shootout — Baggio's miss would (and did) seal their loss. Further compounding this was the fatigue from a gruelling match and extra time and the weight of Italy's expectations on his shoulders.

Physiologically a threat state can trigger increased heart rate and vascular resistance while failing to increase cardiac output, ultimately impairing performance under pressure. Research by Mendes and Blascovich highlights that athletes in a threat state show significant changes in cardiovascular response, such as elevated blood pressure, that negatively impact their ability to perform tasks requiring precision, like a penalty kick. These physiological responses, coupled with the psychological stress, likely played a significant role in Baggio's skill breakdown.

Baggio's skill breakdown is also well explained by reinvestment theory, which posits that under pressure, athletes tend to focus more on the mechanics of their actions rather than allowing automated skills to unfold naturally.[8] This shift from an external focus (eg, aiming for a particular spot in the goal) to an internal focus (e.g., overthinking the mechanics of the kick) can lead to what is often called "paralysis by analysis." Masters and Maxwell describe this as the 'dechunking' of learned skills, where the automatic sequences of actions break down under pressure.[9]

In Baggio's case, his decision to aim for the middle of the goal, combined with his internal reasoning about Taffarel's tendencies, suggests that he may have been thinking too much about the specifics of the kick, thereby losing the automaticity that usually characterizes expert performance. This kind of cognitive interference is well-documented in studies of athletes under pressure, where conscious monitoring of performance can cause even highly practised actions to fail.[10]

Baggio's missed penalty was not just a physical error but likely a psychological response to the enormous stress he was under. The attentional shift from external to internal cues, combined with the physiological impact of being in a threat state, led to a momentary breakdown in his ability to execute the kick. These findings have significant implications for sports psychology and coaching, suggesting the need for interventions that address both the psychological and physiological aspects of performance under pressure.

PROPOSED INTERVENTION: RATIONAL EMOTIVE BEHAVIOURAL THERAPY

Given the complex psychological dynamics at play, Rational Emotive Behavioral Therapy (REBT) emerges as a promising strategy for helping athletes like Baggio manage high-pressure moments. REBT, developed by Albert Ellis focuses on identifying and altering irrational beliefs that lead to emotional distress and underperformance. In high-stakes sports contexts, athletes often adopt irrational beliefs such as 'I must not fail' or 'It would be a disaster if I let my team down,' which heighten anxiety and increase the likelihood of failure. REBT provides a structured approach to challenge and change these beliefs, potentially improving an athlete's performance under pressure.

REBT's ABCDE model helps athletes like Baggio challenge these dysfunctional beliefs. For instance, Baggio may have been thinking, "I cannot miss this

kick, or I will let my country down," which creates a sense of overwhelming pressure (the belief). The consequences of this thought pattern would be heightened anxiety and a threat state, ultimately disrupting his performance (the emotional and behavioural consequence).[12]

By disputing these beliefs through REBT, athletes can shift their mindset from one of demand ("I must not miss") to one of preference ("I would prefer to score, but missing is not the end of the world"). This shift in mindset can have a profound impact on an athlete's performance, reducing anxiety and improving their ability to remain in a challenge state, where they view high-pressure situations as opportunities rather than threats. Studies have shown that such interventions can significantly improve an athlete's performance under pressure, making REBT a promising strategy for managing high-stakes moments in sports.

CONCLUSION

Roberto Baggio's missed penalty in the 1994 World Cup final serves as a powerful case study for understanding the breakdown of sports skills under pressure. By applying the biopsychosocial model, cognitive appraisal theory, and reinvestment theory, we gain insight into how Baggio's shift from automatic to conscious control, exacerbated by his threat state, likely contributed to his failure.

The proposed use of Rational-Emotive Behavioral Therapy (REBT) could offer a valuable approach for helping athletes manage the cognitive and emotional pressures they face during high-stakes competition. By addressing irrational beliefs and shifting athletes toward a challenge mindset, REBT could help prevent future instances of choking under pressure, allowing elite performers to maintain their skills even in the most intense environments.

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CASE REPORT

Thromboembolic complications of COVID-19 leading to Chronic Thromboembolic Pulmonary Hypertension (CTEPH)

Francesca Mercieca, Karl Sapiano, Sarah Bonello

A middle-aged woman was diagnosed with Covid 19. Two months later she was referred to respiratory outpatients in view of worsening shortness of breath and decreased functionality. Investigations including a Computed Tomography pulmonary angiogram (CTPA) lead to the diagnosis of an acute right- sided pulmonary embolism, COVID-19, and bacterial pneumonia. Physical examination and echocardiogram revealed associated right heart strain. Further investigations at follow up confirmed the diagnosis of chronic thromboembolic pulmonary hypertension (CTEPH).

The early diagnosis of the underlying CTEPH has allowed the patient to undergo bilateral pulmonary endarterectomy without undue delay. This was followed by intensive physical and respiratory rehabilitation. In turn the patient improved significantly, so much so that on follow up she was asymptomatic, and she was eventually able to regain her previous functional status.

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Chronic thromboembolic pulmonary hypertension (CTEPH) is a complication of pulmonary embolisation with thrombosis in the microvasculature of pulmonary arteries with development of scarring and eventual pulmonary hypertension. It may lead to right ventricular failure, which not only causes impaired functionality but is also associated with a high mortality.[1]

A connection was found between CTEPH and COVID-19 infection. Both conditions are characterised by endothelial dysfunction with subsequent ventilation/perfusion mismatch, vasoconstriction, thrombosis and inflammation.[2] This case emphasises on how CTEPH can and does occur in patients who have tested positive for COVID-19 and how a high index of suspicion is important for early diagnosis and prompt management to prevent long term complications.

CASE PRESENTATION

A middle-aged lady presented with a three-day history of worsening shortness of breath with sudden deterioration. This was associated with an intermittent non-productive cough. The patient also suffered from hypothyroidism and hypertension and was taking thyroxine and amlodipine as treatment. She had denied any hormonal therapy use. Before the symptoms developed, she had lived an active life and was able to carry out strenuous activities effortlessly.

On examination, the patient was found to have a raised jugular venous pressure 5cm above the sternal angle (upper limit-4 cm above sternal angle), a loud pulmonary component of second heart sound, a few fine crepitations at the right base and mild left lower limb oedema. She was able to maintain good oxygen saturations at rest but desaturated down to 85% upon walking a 50m distance.

Investigations

She had tested positive for COVID-19 at home prior this admission. Initial chest x-ray showed a right upper lobe consolidation as well as cardiomegaly for which a course of intravenous antibiotics was given. In view of a D-Dimer of 2672 ng/mL (0-500ng/ml) this was followed by a computed tomography pulmonary angiogram (CTPA). This showed a right sided pulmonary embolism, as well as findings which were highly suggestive of COVID-19 pneumonia concomitant with bacterial pneumonia in the right upper lobe.

In view of cardiomegaly noted on chest x-ray an NT-proB-type Natriuretic Peptide (BNP) blood test was taken which was found to be 9,060pg/mL (5-125pg/ml).

She was treated with antibiotics, oral steroids and was anticoagulated initially with heparin, then switched to rivaroxaban. She improved and was eventually discharged.

Three months later the patient was reviewed at outpatient and noted to still be suffering from shortness of breath and decreased functionality despite being on anticoagulation therapy.

As part of the work-up spirometry, plethysmography and diffusing capacity of the lungs for carbon monoxide were carried out results illustrated in Table 1, Table 2.

This was followed up with an echocardiogram which showed a pulmonary pressure of 93mmHg (8 - 20mmHg), severely dilated right ventricle and right atrium and a D-shaped left ventricle, in keeping with right sided heart strain. Moreover inferior vena cava was noted to be dilated and was able to collapse less than 50%. An echocardiogram in 2018 had shown normal left ventricular dimensions and global systolic function as well as normal valvular function.

Table 1 *Spirometry*

	Before salbutamol:	After Salbutamol:
FEV	11.96L (72 % predicted)	12.11L (78 % predicted)
FVC	2.79L (83 % predicted)	2.79L (83 % predicted)
FEV1/FVC	87%	94%

Table 2 *Plethysmography and DLCO values*

Parameter	Value
DLCO, mL/mmHg/min	17, 74% predicted
Alveolar volume (VA,) L	4.56
DLCO/VA, mL/mHg/min/L	3.72 (90% predicted)
Total lung capacity, L	5.24 (108% predicted)
Vital capacity, L	2.90 (90% predicted)
Residual Volume, L	2.34 (137% predicted)

Repeat CTPA showed signs of pulmonary arterial hypertension secondary to chronic thromboembolic disease. Pulmonary trunk was dilated to 3.4cm and was larger than the ascending thoracic aorta. A concentric thrombus was lining the right lower lobe pulmonary artery. Subsegmental peripheral pulmonary artery branches manifested sharp cut-off/pruning. These findings were noted to be consistent with chronic thromboembolic pulmonary hypertension (CTEPH).

Patient was then referred to a tertiary centre were CTEPH diagnosis was further confirmed using right heart catheterisation and Ventilation perfusion scanning. Right heart catheterisation showed a severe pulmonary hypertension of the precapillary type with severe increase in vascular resistance.

She was also investigated from a haematological point of view in view of the polycythaemia on blood investigations. Janus kinase 2 V617F (JAK 2V617F) mutation came back as negative. This was followed up by checking for JAK 2 EXON 12 which was also negative. Serum Erythropoietin (EPO) was taken which was normal at 16.3mU/mL (4-26mU/mL), thus not in keeping with polycythaemia Rubra Vera in which case one would expect a suppressed EPO A final impression of secondary polycythaemia in the context of CTEPH was reached.

Treatment

At the time of initial diagnosis of acute pulmonary embolism 3 months ago, the patient was started on rivaroxaban 15 mg twice daily for 3 weeks, which was then switched to 20mg daily thereafter. She was also started on bumetanide at 1mg daily which was later increased to twice daily to control the symptoms of fluid overload because of a right sided heart failure.

The case was discussed with a tertiary centre and it was agreed that the patient would benefit from surgical endarterectomy. Bilateral pulmonary endarterectomy was carried out successfully at a tertiary centre abroad. This involved short intermittent intervals (7-10) minutes of hypothermic circulatory arrest altered with reperfusion periods of at least 5 minutes during which clearance of obstructions in 27 segments on the right and 9 on the left was performed.

After the procedure, she was transferred to the intensive care unit, where she contracted pseudomonas pneumonia which was in turn treated with a course of antibiotics. During her admission at the tertiary centre, she underwent an intense physical and respiratory rehabilitation program.

She was transferred back to the caring hospital and was kept as an inpatient for intense rehabilitation. After the procedure the patient had been started on acenocoumarol which was then changed to warfarin. Novel oral anticoagulants are not yet approved for CTEPH and post- pulmonary endarterectomy, and only vitamin K antagonists are indicated.

Outcome and Follow-up

After physical and respiratory rehabilitation patient was able to maintain oxygen saturations above 94% on exertion without need for supplemental oxygen. Repeat plethysmography was performed which showed a diffusion capacity within normal limits. Patient was deemed fit for discharge with appropriate follow up as well as a scheduled repeat echo in 3 months from procedure.

At the follow up appointment the patient had been doing much better and had seen a significant improvement in functionality, for instance she was now able to walk up a flight of stairs without any shortness of breath. The repeat echocardiogram showed mild dilated right ventricle with normal right ventricular contractility. Moreover the Inferior vena cava was no longer dilated and was now collapsible. In conclusion, there was very significant improvement in right ventricular function.

DISCUSSION

In CTEPH there is an elevated mean pulmonary arterial wedge pressure above 20 mmHg of normal as well as elevated pulmonary vascular resistance above 3 Wood Units. This occurs secondary to the progressive precapillary pulmonary artery remodelling[3]

Chronic thromboembolic pulmonary hypertension is usually known to be a long-term complication of pulmonary thromboembolism. In this patient, the presence of thromboembolism was confirmed by computed tomography which showed a concentric thrombus lining the right lower lobe pulmonary artery. Moreover subsegmental peripheral pulmonary artery branches were shown to manifest sharp cut-off indicating occlusion.

Usually resolution of thrombus in the case of acute pulmonary embolism will occur within six to eight weeks. But in the cases where thromboembolism is chronic there is incomplete clot lysis.[4]

Risk factors for thromboembolism involve pro-coagulant conditions which are found to be present in more than 30% of patients with CTEPH[4]In patients with COVID-19 a common abnormality is coagulopathy, and these patients tend to get elevated levels of both D-dimer and fibrinogen. It was found that venous thromboembolism can occur in COVID-19 positive patients even in patients treated with therapeutic anticoagulation as of admission.[5]

Pulmonary embolism in COVID-19 positive patients is thought to be caused secondary to a local thrombo-inflammatory syndrome induced by a severe acute respiratory syndrome rather than by a thromboembolic event.[6]Inflammation is thought to result in enhanced release of procoagulant factors, thus inducing the coagulation cascade and resulting in de novo thrombosis and fibrin deposition within the pulmonary vasculature.[7]

In a study on patients with non-critical COVID-19, it was found that among patients who presented with respiratory deterioration after being admitted with a diagnosis of non-critical COVID-19, about 20% had a confirmed acute pulmonary embolism. In these patients, the best cut-off value of d-dimer was approximately 10-fold the upper limit of normal.[8] In this case d-dimer was found at 2672ng/mL(0-500ng/ml), which is in keeping with this. Despite the D dimer being a good indication of pulmonary embolism, a high index of suspicion is needed for performing CT pulmonary angiogram to exclude or diagnose an acute pulmonary embolism.

SUMMARY BOX

- COVID-19 has just recently been recognised as an important risk factor for the development of Chronic Thromboembolic Pulmonary Hypertension (CTEPH).
- More awareness is needed regarding the correlation between COVID-19 and CTEPH
- Early suspicion and investigation for CTEPH, in patient presenting with persistent Shortness of breath after COVID-19 infection is paramount for early diagnosis of CTEPH before functional limitation develops.
- CTEPH associated functional limitations have the potential for reversibility if the condition is caught early and managed in a timely manner, therefore a high index of suspicion is needed.

Several retrospective studies have indicated that Computed topography scans have a higher sensitivity (86–98%) and lower false negative rates when compared to Reverse transcription polymerase chain reaction (RT-PCR), in diagnosing COVID-19. This has increased the incidence of CT scans being carried out during the pandemic.[9] Therefore one may argue that the increased incidence of pulmonary embolism during the COVID-19 pandemic could be secondary to the use of Computed Topography as part of the workup for COVID-19 rather that the COVID-19 itself.

There are studies that suggest that patients on thyroid hormone replacement are at an increased risk of developing CTEPH Three European multicentre studies concluded that 19.9% of CTEPH patients were on thyroid hormone replacement therapy while 6.2% of CTEPH patients had a history of hypothyroidism.[10] This patient was known to suffer from hypothyroidism, and this might have been a contributing factor to her developing CTEPH.

CTEPH being a progressive vascular disease, will eventually result in an increased right heart load secondary to pulmonary vascular resistance. This then in turn leads to failure of the right heart.[10] Therefore it goes without saying that this condition causes a significant burden on one's quality of life. This makes its early diagnosis and thus management crucial to avoid its advancement.

The pattern of right sided strain secondary to pulmonary hypertension was seen clearly in the patient being discussed as both physical examination and an echocardiogram done were consistent with a right sided heart strain with right sided dilation.

Although patients may have little to no limitation at first, they may get eventual progression to overt limitation on exercise and ultimately right ventricular failure and death.[4] Our patient presented with symptoms of CTEPH about four months after testing positive for COVID-19, thus a high index of suspicion led us to connect the dots and come to the right diagnosis.

Management options for patients with CTEPH involve Pulmonary endarterectomy, balloon pulmonary angioplasty, medical therapy, lung transplantation or a combination of the former.[11]

Pulmonary endarterectomy (PEA) can result in total resolution of pulmonary hypertension in some patients. PEA is usually used as first-line therapy. Whether one goes for surgery or not depends on several factors, mainly including the anatomic extent of obstruction, the degree of microvascular disease as well as taking into consideration the haemodynamic of the pulmonary vasculature and the right ventricular function. The patient's health status and comorbidities also play a role in whether to choose surgery as the management of choice. Saying all this, the decision should be taken at a multidisciplinary level.[4]

In this case surgery was the treatment of choice and the procedure was carried out successfully with the patient gaining better functionality and normalisation of both respiratory and cardiac function.

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ORIGINAL ARTICLE

Burkitt's Lymphoma In 3 Years-Old Boy With Craniofacial Presentation

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Background

Burkitt's lymphoma (BL) is an aggressive non-Hodgkin B-cell lymphoma with rapid growth. The majority of endemic BL occurs in children aged 5-12 years old with mandibular involvement.

Case

We presented a rare case of BL in 3 years-old boy with craniofacial involvement in Indonesia. A boy came to the emergency department with a massive mass in the upper-left facial area. The mass was 10 x 5 x 5 cm with eye and maxillary infiltration. Three months before, the patient came to the outpatient clinic with a slightly-visible and painless mass in the left cheek without any lymph node enlargement. The blood examination revealed no abnormalities, yet the LDH level was 1.260 U/L. The histopathological examination supported the diagnosis of Burkitt's lymphoma. No leukemic cells or metastases were found in bone marrow aspiration. The patient received Cyclophosphamide, Vincristine, Methotrexate, and oral prednisone. The patient responded well and the mass was completely resolved in 3 weeks with no complications.

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Figure 1 *(A) Initial presentation at the outpatient clinic; (B) Massive tumor on 5th day; (C) the tumor was significantly reduced on day 10th*

Burkitt's lymphoma (BL) is a rare aggressive high-grade B cell lymphoma with a rapid doubling time of 24–48 hours.[1] In Indonesia the incidence of BL is unclear due to limited tools and resources for diagnosing BL[2,3] Medical records from our hospital in Surabaya Indonesia revealed only 5 cases of BL from 2015 to 2019. The majority of BL occurrs in children aged 5-12 years old with jaw involvement.[4] We reported a case of 3 years old boy diagnosed with BL and craniofacial involvement.

CASE REPORT

A three years-old-boy came to the emergency department with a massive mass in the upper-left facial area. The mass was aggressively enlarged 3 months ago followed by severe pain 2 weeks ago. Fever hypersalivation, and sore throat were denied. The nutritional intake was decreased with significant weight loss. Three months before, the patient came to the outpatient clinic with a slightly-visible and painless enlargement in the left cheek without any lymph nodes involvement (Figure 1A). However the parents rejected hospital admission during the outpatient visit.

Based on physical examination, the mass was 10 x 5 x 5 cm, solid, and fixed without signs of inflammation. The mass had been infiltrated the eye and maxilla causing partial obstruction of the mouth. Minor gum bleeding was observed at the mass. Cervical submandibular, and submental lymph nodes were enlarged. No abnormalities were found in the chest, abdominal, and extremities. Neurological examination was normal.

Laboratory examination upon emergency admission showed no abnormalities (hemoglobin 10.9 mg/dL), yet the lactate dehydrogenase (LDH) level was 1.260 U/L The rapid HIV test was non-reactive. Peripheral blood smear revealed heterogenous normochromic-microcytic erythrocytes; impression of lymphocyte dominance with atypical lymphocytes; and increased platelet count. The patient was planned for fine-needle aspiration biopsy (FNAB) and bone marrow aspiration (BMA).

On the 5th day of admission, a massive gum bleeding (50 mL) from the mass occurred. The general condition was weak with poor oral intake. The hemoglobin and hematocrit were reduced to 9.5 mg/dL and 27.1%, respectively. The FNAB result demonstrated a malignant round cell tumor supporting BL (Figure 2). No malignancy cells were observed on BMA

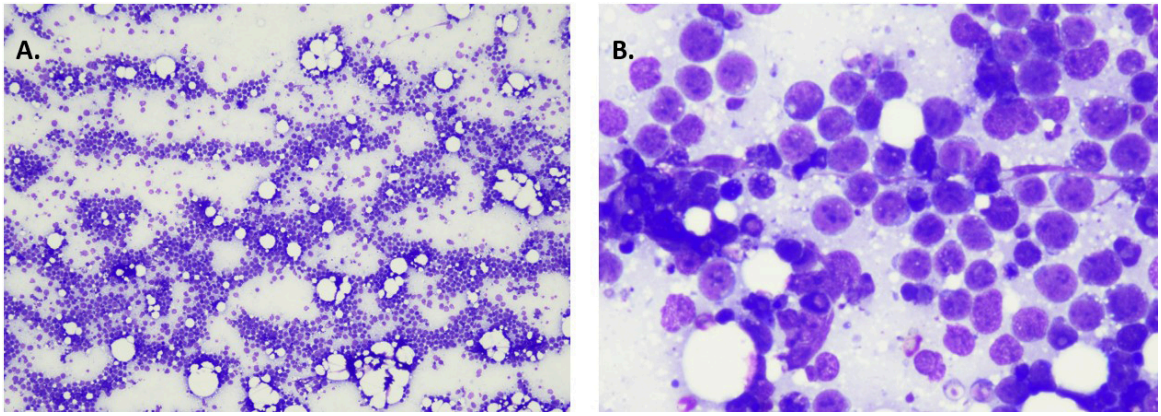

Figure 2 *FNAB finding (A) hypercellular smear with homogenous round anaplastic cells; (B) intermediate-sized anaplastic cells with round nuclei containing coarse chromatin, thin cytoplasm, and some lipid vacuoles.*

The patient was diagnosed with BL After bleeding control and transfusion, the patient received chemotherapy with Cyclophosphamide Vincristine Methotrexate and oral prednisone. The intake was partially supported by parenteral nutrition. The patient responded well, the mass size was reduced after the first regimen of chemotherapy. The nutrition could be administered orally. The LDH and uric acid levels were 480 U/L and 1.1 mg/dL, respectively. No abnormalities were found on the liver and kidney function test. After 3 weeks, the mass was completely resolved without any complication (Figure 1C). The patient was stable and went to the hematology outpatient clinic every 2 weeks.

DISCUSSION

Burkitt's lymphoma is an aggressive high-grade B cell lymphoma with rapid mass progression.[1] Burkitt's Lymphoma is classified into three types, endemic, sporadic, and immunodeficiency-related. The endemic type is the most common, especially in children. The clinical symptoms include typical painless mass around the jaw with/without intra-oral extension such as dental problems. The BL often occurs in males aged 5-12 years old, with peak incidence near 10 years old.[4,5] Our case demonstrated that endemic BL could occur in children aged under 5 years old with craniofacial involvement.

The patient experienced significant weight loss and nutritional problems which are typical for endemic BL patients.[1] In this patient, the significant weight loss is most likely due to the progressive enlargement of the tumor causing partial obstruction of the mouth and intake limitation. In addition, the high energy requirement for cancer cell proliferation also caused energy deprivation and malnutrition among BL patients.

The diagnosis of this patient was based on the FNAB result which supported BL findings. Histologically Burkitt Lymphoma is characterized by a diffuse growth pattern without any nodularity. The microscopic features of typical BL are homogenous intermediate-sized cells with round nuclei containing coarse chromatin, and multiple small nucleoli admixed with tingible body macrophages creating a "starry-sky" pattern visible at low power. Mitotic and apoptotic activity is typically a prominent feature.[6] Early pathological finding leads to early diagnosis which remains a key factor in pediatric oncology as it allows for early detection and proper treatment.

From the laboratory finding, the hemoglobin was normal during the first admission to the emergency department (10.9 mg/dL), yet major gum bleeding occurs on the 5th day causing a significant reduction of the hemoglobin (9.5 mg/dL). However after bleeding control and transfusion, the hemoglobin was recovered to 15.4 mg/dL It is plausible that the bleeding source was from the BL since BL has a rapid doubling with angiogenesis activity.[7]

The first-line treatment for all types of BL is intensive-short courses of chemotherapy combinations such as cyclophosphamide, vincristine, prednisone, doxorubicin, alkylators, and etoposide. No surgical or radiotherapy intervention is needed in managing BL Given the high dose and intensive chemotherapy administered during BL treatment, drug toxicities and complications are common. In addition, tumor lysis syndrome is a potential complication due to the rapid suppression of tumor cells.[1,6] Fortunately the patient responded well to chemotherapy. The uric acid after chemotherapy was normal, indicating no tumor lysis syndrome occurred.

Despite massive tumor size, bleeding, and nutritional problem, the patient had a good prognosis since the patient completely responded to chemotherapy. The tumor was not visible, hemoglobin was recovered, and adequate oral intake. The survival rate for BL had been improved over the years since numerous advances in diagnosis and treatment. Patients aged 19 years old or less have the best prognosis with 87% 5-year survival, while older patients and those with advanced disease have the worst prognosis.[6]

CONCLUSIONS

Burkitt's lymphoma is a rare tumor in children aged under 5 years old. Early clinical and pathological examination is the key factor for diagnosing BL.

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