

# A study on plain X-ray skull imaging in the public Primary Health Care Department in Malta

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## ABSTRACT

### Background

In January 2014, the National Institute for Health and Clinical Excellence (NICE) published the guideline [CG176]: Head injury: assessment and early management. These guidelines advise that plain X-rays of the skull should not be used to diagnose significant brain injury without prior discussion with a neuroscience unit. However, they are useful as part of a skeletal survey for suspected non-accidental injury in children.

### Objectives

Our study was conducted to quantify the skull X-rays performed over a period of 12 months and review whether the cases adhere to the NICE guideline [CG176]: Head injury: assessment and early management.

### Method

A descriptive, retrospective, cross-sectional study design was applied. Data was obtained from the Radiology Information System (RIS) and the Picture Archiving and Communication System (PACS). The Statistical Package for Social Sciences Version 20 was used in the data analysis.

### Results

There were 127 skull X-rays performed in primary health care centres in 2016. The majority of patients were males (56%,  $n = 71$ ). There were 83 (65.4%) skull X-rays requested for cases of trauma or queries about fractures. Around 3% of requests ( $n = 4$ ) were made to exclude foreign bodies.

### Conclusion

After reaching the study objectives, it was noted that there is a need to increase awareness of the NICE guidelines to improve the use of skull radiography thus ensuring more efficient resource utilisation.

## Keywords

Primary health care; quality of health care; medical imaging; head injury

## INTRODUCTION

Head injury is a highly prevalent event and can cause significant morbidity and mortality (Hofman et al, 2000; NICE Guidance, 2017b; Thompson et al, 2015). In January 2014, the National Institute for Health and Clinical Excellence (NICE) published the guideline [CG176: Head injury: assessment and early management].

These guidelines advise that plain X-rays of the skull should not be used to diagnose significant brain injury without prior discussion with a neuroscience unit. However, they are useful as part of a skeletal survey for suspected non-accidental injury in children. These guidelines were used as the gold standard for this current audit. In June 2017, NICE updated these guidelines with cross-references to related NICE clinical guidelines (NICE Guidance, 2017a).

The Royal College of Radiologists state that with the near-universal availability of Computed Tomography (CT) scanning in the United Kingdom, the Skull X-Ray (SXR) can almost never be justified in the assessment of a patient with head injury. Moreover, this College states that no patient should have a SXR performed in addition to or instead of a CT scan of the head (The Royal College of Radiologists, 2017). The absence of a fracture on an SXR can be falsely reassuring. Furthermore, SXR is suboptimal in showing a basal skull fracture (The Royal College of Radiologists, 2017).

The current primary investigation of choice for the detection of acute clinically important brain injuries is CT imaging of the head because it is generally readily available, can be performed in a short period

of time and reliably detects acute haemorrhage (NICE Guidance, 2017b; The Royal College of Radiologists, 2017). Due to safety, logistic and resource reasons, MRI scans are usually reserved for follow-up of patients with abnormalities detected on the CT scan or for further evaluation of subtle abnormalities (The Royal College of Radiologists, 2017; NICE Guidance, 2017b).

This study was conducted to quantify the SXR performed over a period of 12 months and review the cases that adhere to the NICE guideline [CG176]: Head injury: assessment and early management. The objectives of the study included examining the sociodemographic data of patients who undergo SXR radiography, reviewing the indications for SXR radiography in a primary healthcare setting and investigating the adequacy of its documentation.

## METHOD

A descriptive, retrospective, cross-sectional study design was applied. All requests for plain SXR radiographs taken in public primary health care centres between January and December 2016 were obtained from the Radiology Information System (RIS) and the Picture Archiving and Communication System (PACS). The data was obtained in an anonymous manner.

The patients' demographic and clinical characteristics were noted. This includes recording the medical question and the clinical comment inputted by the requesting physician. Data analysis was subsequently carried out using the Statistical Package for Social Sciences Version 20.

Patients who underwent plain SXR radiography in a public hospital or in the private sector were excluded from this study.

Approval for this study was obtained from the Data Protection Officer of the Primary Health Care Department.

## RESULTS

There were 127 SXRs performed in public primary health care centres in 2016. The majority of patients were males (56%,  $n = 71$ ). The sample population had an age distribution of 1 - 94 years with a mean of 44 years. Figure 1 shows the total number of SXRs performed in each month. The highest number of SXRs was performed in March and May whilst only five such X-rays were done in December. A Kruskal-Wallis Test revealed statistically significant difference in the total number of SXRs performed per month,  $p = <0.001$ .

There were 83 (65.4%) SXRs requested for cases of trauma or queries about fractures (Figure 1). The mean age of these patients was 44 years whilst the age range was 1 year – 94 years. The majority were males (56%,  $n = 47$ ). The highest number of X-rays was requested in March and the least number occurred in February. A Kruskal-Wallis Test revealed statistically significant difference in these SXRs performed per month,  $p = <0.001$ .

There were 16 patients (13%) referred for plain skull X-ray due to history of headaches. Out of the latter requests, 9 X-rays were performed due to suspicion of sinusitis. Furthermore, 11 skull X-rays were performed due to the presence of a lump whilst 5 were performed due to pain. Around 3% of requests ( $n = 4$ ) were made to exclude foreign bodies. These patients were all males with a mean age of 34 years. The medical question documented in 2 cases was Paget's disease. There was one case of suspicion of metastases and another case of dizziness and double vision. There was no medical documentation accompanying the imaging request in 3% of cases. Furthermore, there were no documented reports for consultations with the neuroscience unit.

There were no cases of suspected non-accidental injury documented on the imaging request. In 5 cases, CT brain was subsequently performed. There were fractures of the nasal bones in 2 patients. No acute intracranial abnormality was demonstrated.

## DISCUSSION

Similar to the findings of another local study conducted in 2008, the majority of patients undergoing imaging were males (62% vs. 56%) with an age distribution of 1-94 years (Cassar et al, 2008). Head injury is a common consequence of accidents and violence (Gisladottir et al., 2014). Studies have suggested that men may show more risky behaviour when driving motor vehicles and at work (Jonsson et al., 2016; Gisladottir et al., 2014; Dzupa et al., 2009). Locally, further research can be conducted to explore the mechanisms of injury of those patients undergoing medical imaging in primary health care.

The total number of requests for skull X-rays was the lowest during winter. This might be because accidents tend to be more prevalent during spring and summer (Jonsson et al., 2016). Furthermore, this time period also marks the beginning of quarterly rotations of foundation doctors and general practitioner trainees who might still be getting accustomed to the system and guidelines (Cassar et al, 2008).

In the current study, doctors' or patients' concern for serious pathology and patients' expectations might have influenced diagnostic imaging. A US-based cross-sectional survey of emergency physicians at a national meeting showed that the two most frequently cited reasons for providing low-value services were "patient and family expectations" and "concern for serious diagnosis." (Lin et al., 2017). Further local qualitative research can address these notions.

Similarly, another prospective Scottish study by Kerr et al demonstrated that SXR's continued to be performed in patients without SIGN indications. The authors postulate that this may represent pressure from the patients or it may be related to the grade and clinical experience of the doctor requesting the investigation. A previous study by McNally et al assessed patients' reactions to not having skull radiography performed, and demonstrated that, of 705 patients questioned, 51% said they expected a SXR to be performed, and of these 63% had left the department disappointed (McNally et al, 1996).

The results suggest that there is a need for further awareness of the NICE guidelines to try to avoid ineffective investigations which can result in potential physical and psychological harm to the patients, thereby improving clinical effectiveness, professional competence and behaviour. It might be argued that physicians opt for plain skull imaging due to medicolegal issues or because CT scans are not readily available in a primary care setting. Cassar et al (2008) stated that such audits may help reduce the workload in the radiology department to report large numbers of skull X-rays which are of little diagnostic utility (Cassar et al., 2008).

Adherence to NICE guidelines may help to reduce the rates of skull X-rays and hence reduce system demands, healthcare expenditure and unnecessary

radiation exposure (Cassar et al., 2008). This clinical study showed the need to enhance the adequacy of the clinical request form for plain skull radiography to facilitate the radiologists' reporting process, thus strengthening interdisciplinary communication. Furthermore, this will enhance clinical governance to ensure that the standards of care are maintained and that the system is accountable to the patients.

Several limitations were identified in the present study. Due to time and resource constraints, radiographs carried out in Gozo, in the public hospital and in the private sector were not included. Other limitations include being based solely on medical imaging request forms and being non-random and retrospective in nature. Moreover, this study did not assess whether these imaging services were cost-effective and whether patient expectations were met. Future research can address these limitations.

## CONCLUSION

After reaching the study objectives, the results suggest that there is a need for further awareness of the NICE guidelines to enhance appropriate use of skull radiography to ensure more efficient resource utilisation.

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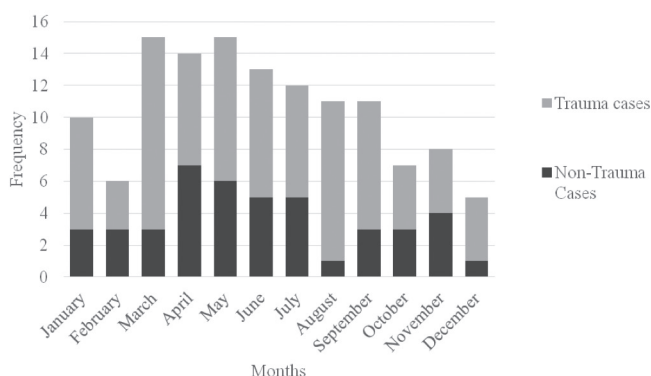
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Figure 1: Graph of SXR's per month



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