An evaluation of the use of nasal bones imaging in primary care in Malta

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ABSTRACT

Introduction

Fractures of the nasal bones are one of the commonest injuries sustained in facial trauma. The purpose of this study was to evaluate the use of nasal bone x-rays in the public primary care department in Malta and whether this has an impact on subsequent follow-up of patients presenting with nasal trauma.

Method

This was a retrospective cross-sectional observational study. Data of all nasal x-rays requested in primary health care during the year 2018 was gathered. Data input and analysis was carried out using Microsoft Excel® 2016.

Results

A total of 212 nasal bone x-rays were taken in primary care over the one-year study period, amounting to 65% of the total number of nasal x-rays taken in the public health sector in Malta. The majority of the patients were males. The most frequent age group was 21 to 30 years. The highest number of nasal bone x-ray requests (37.7%) was for unspecified trauma, followed by trauma secondary to a fall (25.9%), and trauma secondary to fights or assaults (16.5%). The majority (67%) of x-rays were reported as normal. Thirty point two per cent of all patients who had a nasal bone x-ray taken were referred to the Accident and Emergency (A&E) Department on the same day and 28.3% had Ear, Nose & Throat (ENT) Outpatients follow-up.

Conclusion

A substantial number of nasal bone x-rays are performed in the primary health care department in Malta on a yearly basis. Only a slight majority of those referred to ENT had an abnormal x-ray report, in keeping with data from previous studies highlighting the limitations of nasal x-rays in planning further management.

Keywords

Nasal bones, radiography, primary care.

INTRODUCTION

Fractures of the nasal bones are one of the commonest injuries sustained during facial trauma (Johnston and Jones, 2017). This is in view of the prominence of the nose, making it more susceptible to injury (Koh, et al., 2016). Common mechanisms of injury resulting in trauma to the nasal bones include falls, motor vehicle accidents, involvement in fights or assaults, and sports injuries.

The assessment of trauma to the nose should include a comprehensive history exploring the mechanism of injury and symptoms thereafter, and a thorough examination. Physical examination is the main means through which isolated nasal bone fractures are diagnosed and management depends heavily on the clinical findings (Haraldson, 2018; Hoffman, 2015; Johnston and Jones, 2017; Koh, et al., 2016; Kucik, Clenney and Phelan, 2004; Sciberras and Borg Xuereb, 2008). Clinical examination is important in order to identify and manage any

resulting immediate complications, and thus preventing complications occurring at a later stage. Late complications might include nasal deformity, septal necrosis, airway obstruction and psychological disturbance (Sciberras and Borg Xuereb, 2008).

The value of plain radiographic imaging (x-rays) in the diagnosis and management of nasal bone injuries has been found to be very limited, and may at times also be confusing (Hoffman, 2015; Johnston and Jones, 2017; Koh, et al., 2016; Kucik, Clenney and Phelan, 2004; Haraldson, 2018). Fifty per cent of injuries subsequently confirmed to include a nasal fracture are initially missed on plain x-rays, and conversely, suture lines, vascular markings and old fractures can all result in false positive reports, even by radiologists trained in this field (Kucik, Clenney and Phelan, 2004; Haraldson, 2018; Hoffman, 2015). In summary, decisions on management of trauma to nasal bones are largely dependent on clinical features and nasal x-rays are thus not indicated (Oluwasanmi and Pinto, 2000; European Commission Directorate-General for the Environment, 2000). Furthermore, should there be the presence of extraocular movement abnormalities, cerebrospinal fluid (CSF) rhinorrhea or malocclusion of the jaw, a computerized tomography (CT) scan is the imaging modality recommended to assess for mandibular, facial or base of skull fractures (Kucik, Clenney and Phelan, 2004; Koh et al., 2016).

Despite this, a significant number of nasal bone x-rays are performed in both primary and secondary care in the public health sector in Malta.

The aim of this study was to evaluate the use of nasal bone x-rays in the public primary care department in Malta. The objectives of this study were:

- To quantify the number of nasal bone x-rays taken in primary care.
- To describe the patient demographics, reason for x-ray request and source of referral for the x-ray.
- To analyze the results of the nasal bone x-rays performed in primary care and any subsequent follow-up organized for the patients in secondary care.

METHOD

Data collection

This was a retrospective cross-sectional observational study. A list of all nasal bone x-rays taken during the period of 1st January 2018 till 31st December 2018 in both primary and secondary care in the public health sector in Malta (that is, all Government Health Centres and Mater Dei Hospital) was compiled using the GE Health Care Centricity Universal Viewer® system.

Subsequently, a form was designed using Microsoft Excel® to facilitate collection of data. Since this study focused on the nasal bone x-rays taken in primary care, only data of the nasal bone x-rays taken in Government Health Centres was collected. This was done using the iCM® (Information Clinical Manager) and GE Health Care Centricity Universal Viewer® system.

Data collected included the following:

- The month, day and time that the x-ray was taken.
- The age, gender, locality and nationality of the patient.
- The source of referral for the x-ray.
- The reason for the x-ray request. This list was compiled after a review of all x-ray requests.
- Whether the x-ray result was normal or abnormal.
- Whether the patient had a registered Accident and Emergency (A&E) department episode on the iCM® system on the day the x-ray was taken.
- Whether the patient had an Ear, Nose & Throat (ENT) outpatients episode registered on the iCM® system in the month after the x-ray was taken.

Data analysis

Data input and analysis was carried out using Microsoft Excel® 2016.

Study approval

Approval was obtained from the Department of Primary HealthCare and the Data Protection officer of the Department prior to the commencement of the study.

RESULTS

Number of nasal bone x-rays

During the period of 1st January 2018 to 31st December 2018 a total of 324 nasal bone x-rays were taken in Mater Dei Hospital and Government Health Centres. Of these, 212 nasal bone x-rays, i.e. 65% of the total number of x-rays, were taken in primary care. Our study will focus on the x-rays taken in primary care.

Demographic details

The majority of patients (53.8%) who had a nasal bone x-ray taken in primary care over the one-year study period were males, and 46.2% were females. The age range was 4 to 91 years, with the most frequent age group being 21 to 30 years. The age/gender distribution of these patients is reproduced in Figure 1.

The majority of patients (85.9%) were Maltese, with 14.1% being non-Maltese nationals.

Most x-rays were requested at Paola Health Centre (33%), followed by 29.7% at Mosta Health Centre and 16.5% at Floriana Health Centre.

Month, day and time

The highest number of nasal bone x-rays were found to be taken during the summer months of July (12.3%) and August (12.3%). This was followed closely by March (11.8%) and May (9.9%). Figure 2 gives a detailed representation of these findings.

Most of the nasal bone x-rays were performed during weekdays (75%), with the rest being taken on Saturday and Sunday. Table 1 illustrates the percentage of nasal bone x-rays taken by time of day. The majority of x-rays are performed between 08:00 and 17:00, during both weekdays

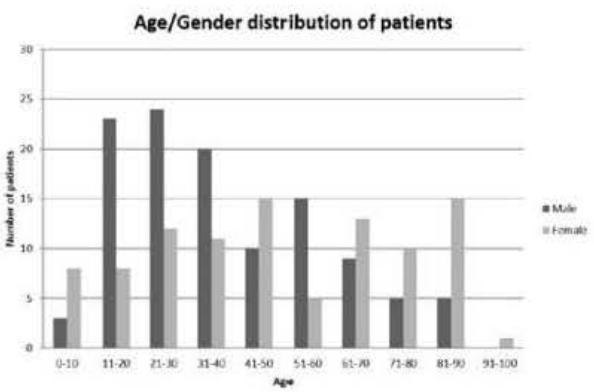

Figure 1: Age/gender distribution of patients who had a nasal bone x-ray performed

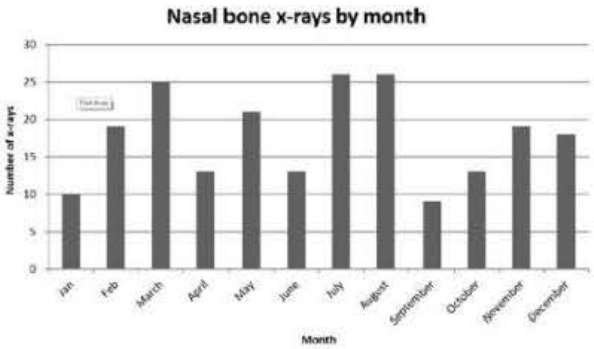

Figure 2: Distribution of nasal bone x-rays by month of the year

and weekends. Of particular note is the higher percentage of x-rays taken between 20:00 and 08:00 on a Sunday when compared to the rest of the week.

Source of referral for x-ray

The majority of nasal bone x-rays taken were requested by General Practitioners (GPs) working in the public sector (70%). This was followed by Foundation Year 2 (FY2) doctors (14%) and GP trainees (12%). Only 4% of nasal bone x-rays performed were requested by GPs in the private sector.

Reason for x-ray request

The highest number of nasal bone x-rays (37.7%) were requested for trauma, the type of which was not specified by the doctor on the request form. This was followed by trauma secondary to a fall (25.9%), and trauma secondary to being involved in a fight or assault (16.5%). No clinical details were provided in 6.6% of cases. Trauma secondary to sports injuries added up to 5.2% of cases, and 4.7% were documented police cases. A graphic representation of these results can be seen in Figure 3.

X-ray findings

The majority (67%) of the nasal bone x-rays were reported as normal, with the remaining 33% reporting a fracture of the nasal bones. Figure 4 gives a detailed graphic representation of the reasons for request of the x-rays which were reported as abnormal.

	Day of the week		
Time	Mon- Fri	Sat	Sun
08:00 - 17:00	70.8%	78.1%	50.0%
17:00 - 20:00	14.6%	15.1%	18.2%
20:00 - 08:00	14.6%	6.3%	31.8%

Table 1: Percentage of nasal bone x-rays taken by time of day

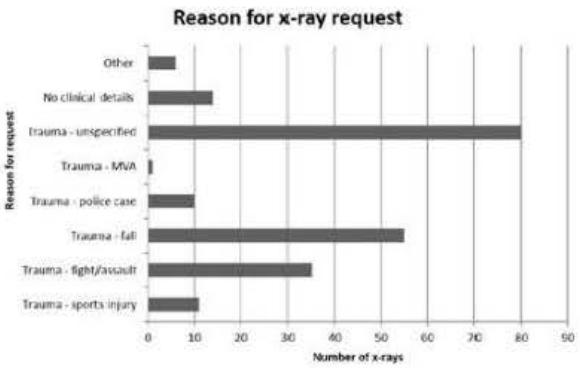

Figure 3: Reason for nasal bone x-ray requests

Patient follow-up

From the total number of patients who had a nasal bone x-ray taken, 30.2% were referred to the Accident and Emergency (A&E) Department on the same day the x-ray was performed. Of these, 36% had a normal x-ray result and 64% had an abnormal x-ray result. The majority of those referred to A&E had been initially referred for the x-ray in view of trauma secondary to a fall.

From the total number of patients who had a nasal bone x-ray taken, 28.3% had a registered Ear, Nose & Throat (ENT) Outpatients appointment in the four weeks following the date of the x-ray. Of those who had an ENT visit, 68% had been referred to A&E on the day the x-ray was taken. Fifty-four point three per cent of those who were seen at ENT outpatients had an abnormal x-ray result. The majority of those who were seen at ENT were referred for x-ray in view of trauma secondary to a fall (40%), followed by trauma which was not specified (25%) and trauma secondary to fights/assaults (11.7%).

The flowchart in Figure 5 summarizes the patient referrals to secondary care (A&E and/or ENT) according to the nasal bone x-ray results.

Further analyses

Age/gender and reason for nasal bone x-ray request

In females, trauma secondary to falls was the commonest documented reason for nasal x-ray request in all age groups except the 20-40 year age group. This was highest above 60 years of age with 63.2% of requests being for this reason. In the 20-40 year age group, trauma secondary to fights or assaults was the commonest reason for x-ray request.

The trend was similar in males, with trauma secondary to fights or assaults being the commonest documented reason in the 20-40 age group, and falls being commonest in males above 60 years (50% of requests in this age group).

Season and reason for nasal bone x-ray request

On further analyses, data of reason for x-ray request were analyzed according to season, i.e. winter (January to March), spring (April to June), summer (July to September) and autumn (October to December) and any notable trends were recorded.

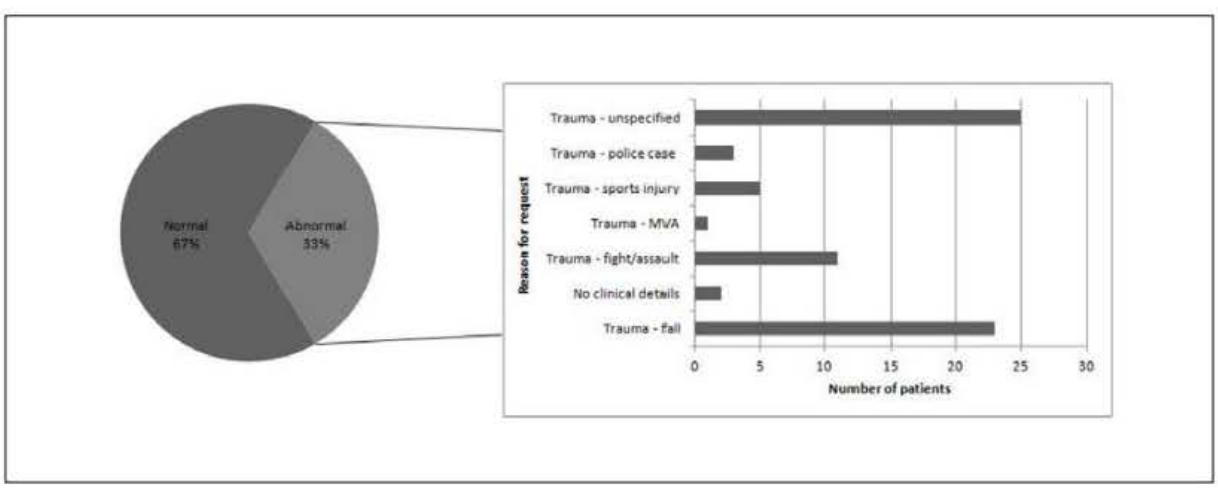

Figure 4: Nasal bone x-ray results and reason for request in x-rays reported as abnormal

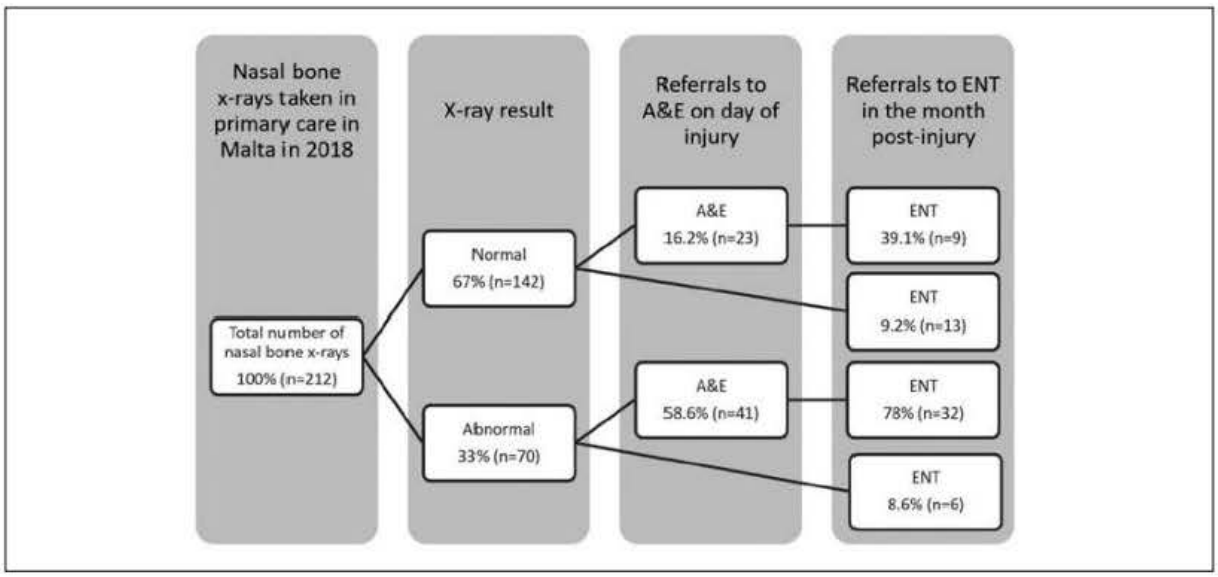

Figure 5: Summary of the referrals to secondary care according to the nasal bone x-ray results

The greatest number of x-ray requests for trauma secondary to falls were recorded during the winter period (37% of all x-rays taken during those months), followed by autumn (30%).

Nasal bone x-ray requests for trauma secondary to fights or assaults were most common during the summer months (24.6% of all x-rays taken during that season), followed by autumn (18%). X-ray requests documenting police cases were also most common during the summer months.

X-ray requests in view of trauma secondary to sports injuries were very similar throughout all seasons.

DISCUSSION

The substantial amount of nasal x-rays performed in health centres in Malta suggests that doctors in primary care might have a lower threshold for ordering nasal bone x-rays when compared to doctors in secondary care. Another reason for this high number of x-ray requests might be that patients with facial or nasal trauma tend to present initially to primary care rather than A&E.

Data collected and analyzed for the purpose of this study revealed a number of findings worth mentioning. Of particular note is that males were more likely to sustain nasal trauma when compared to females, and the age group affected the most was that between 21 and 30. This is similar to previous findings documented in the literature (Fornazieri et al., 2008; Bremke et al., 2009, Hameed et al., 2014). The commonest documented reason for request in this age group was trauma secondary to being involved in fights and assaults. This may be explained by this age group of males partaking in more high risk behaviour, including altercations and dangerous sports activities. In contrast, females were more likely to sustain nasal trauma as their age progressed, when compared to men, with the over 60s consistently including substantially more female patients than males. Above 60 years of age, the commonest reason for request was trauma due to falls at 63.2%, which is similar to the results of the studies carried out by Fornazieri et al. (2008) and Bremke et al. (2009). Overall, the commonest documented reasons for nasal bone x-ray requests were falls, followed by fights or assaults, which is also shown in the study by Bremke et al. A study by Trinidade et al. (2013) showed that the incidence of nasal fractures in the UK was rising especially among girls and women, and this very often was a result of assault. In this study, x-ray requests in females for trauma secondary to fights or assaults was commonest in the 20 to 40 age group, and this type of injury should therefore always be kept in mind when assessing this cohort of patients.

Requests for nasal bone x-rays due to falls were noted to be more common during autumn and winter. It can be argued that the rainy weather increases the risk of falls. Similarly, requests for x-rays in view of trauma secondary to fights or assaults were noted to be higher during the summer months. Again it can be

argued that people tend to be outdoors and stay out later than usual during the months when the weather is good and days are longer. Notably, there was a higher percentage of x-rays taken on a Sunday night when compared to the rest of the week. This can be thought to be due to a higher rate of injuries when people are out on Sundays, which is often a day when people have time to participate in outdoor activities which might increase their risk of injury.

In this study, 74% of nasal x-rays were requested by GPs, in comparison to 12% requested by GP trainees and 14% by foundation doctors. This finding may be due to foundation doctors and GP trainees being more up-to-date with recent management guidelines. Of particular note is that GP trainees in Malta have a diverse and comprehensive training programme encompassing a multitude of different specialties, including ENT, and thus this may result in less unnecessary x-ray requests by this cohort of doctors. However, it is also worth noting that there are a greater number of fully qualified GPs when compared to GP trainees and foundation doctors, making the likelihood of the former requesting more nasal x-rays greater by probability. A study performed by Agrawal and Brayley in 2007, revealed that, after appropriate teaching of junior doctors within the Emergency Department, appropriate nasal clinical examination and documentation rates increased remarkably from 30% to 97%, with the rate of facial and nasal radiographs performed decreasing from 42% to 0%.

Out of the total nasal x-rays reported by a radiologist as 'abnormal' in this study, only 58.6% were referred to A&E for urgent review on the day, with 78% of these being given a subsequent ENT outpatients appointment. Notably, out of the total number of patients having an abnormal x-ray, just over half (54.3%) had an ENT appointment scheduled urgently for specialist review. The rest of the patients with an abnormal x-ray, comprising 32.8%, were discharged from primary care without subsequent ENT follow-ups or A&E review. However, further quantitative research can investigate whether there is an association between nasal bone x-ray findings and subsequent follow-up or secondary care referral.

A sizable proportion of requests (16.5%) were specifically for trauma due to assault. Thus, it might be plausible to postulate that x-rays may have been requested for medico-legal purposes. Yet, an analysis of Maltese law may prove such requests unnecessary, particularly because the reporting of fractures may not have legal implications when filling out police reports and grading the nature of harm. According to Maltese law, a nasal fracture resulting in nasal obstruction or deformity is to be considered as grievous bodily harm. Moreover, an injury need not necessarily involve a fracture for it to be deemed grievous. Lacerations that will leave a scar on the nose (and thus the face) or any harm that results in adverse psychological effects for a period of more than 30 days should be considered as grievous bodily harm. Conversely, in light of the fact that nasal fractures in healthy adults heal within an average time span of 3 weeks, non-displaced, uncomplicated fractures may fall under the category of slight bodily harm (Sciberras and Borg Xuereb, 2008).

Strengths and limitations

Since this study incorporated data pertaining throughout an entire year, the cohort included a substantial number of patients thus providing an adequate representation of the whole year. Despite variations between the months, with the highest number of requests being in July and August, seasonal bias was not a feature that could skew data in this study. This is one of the advantages derived from comprehensive data collection. Moreover, since x-rays from all health centre regions were pooled into this study, regional bias did not play a feature in the results.

The online x-ray request form on the iCM® system proved to be an asset in this study. Obligatory information fields directing the physician to specify the reason for request and suspected pathology helped to allow analysis of the prevalence of specific reasons for request in the context of patient demographics. Unfortunately, a limitation was the minimal information given at times, as exemplified in this study by the majority of requests being for 'trauma', but not specifying any further. Indeed, a clearer picture delineating the precise

mechanism of injury and outlining clinical findings would have been useful both for the radiologist interpreting the x-ray, as well as for the purpose of this study to ascertain whether any clinical findings were suggestive of complicated nasal fractures.

One of the limitations of this study was that patient notes were not reviewed. In view of this, the precise reason for A&E referral could not established and ENT reviews may have been underscored, as reviews not registered on the iCM® system would have been missed. Furthermore, since patient notes were not reviewed, the clinical presentation as to whether there was a clinically evident fracture of the nasal bones could not be ascertained. Had this been done, it would have been possible to calculate sensitivity and positive predictive value of nasal bone x-rays for our population study.

Future research can tackle the nasal bone x-rays taken in secondary care, and compare the source of referral, reasons for request and subsequent follow-up in these two groups of patients.

Interpretation of nasal x-rays has a high reporter bias, with false negative rates of 50% (Sciberras and Borg Xuereb, 2008). Thus, in the compilation and stratification of reports as normal and abnormal, it is worth noting that a number of reports could have been falsely declared as being normal, whilst it is also possible that there were a number of false positives. For the purpose of this study, the actual x-rays were not reviewed again, and the reports were taken as final.

Furthermore, this study did not assess whether such x-ray requests were grounded in evidence-based medicine or whether they were cost-effective.

Recommendations

Since the majority of x-rays (65%) were requested in primary care, it would be highly appropriate to focus on educational campaigns aimed towards GPs. This can be done through organizing lectures and workshops about the diagnosis and management of nasal trauma. Forwarding updated literature and guidelines via email to all GPs may also be useful to serve as a reminder. Developing local guidelines to serve as a guide for doctors in primary care might also be a valuable resource. Moreover, relevant legal advice should be made more accessible, by organizing seminars led by licensed legal advisors serving as an opportunity for GPs to clarify any queries or issues. This is of particular importance for the GP when filling out police reports and would also help to reduce unnecessary over-investigation for this specific purpose.

CONCLUSION

A substantial number of nasal bone x-rays are performed in the Primary HealthCare department in Malta on a yearly basis. Only a slight majority of those referred to ENT had an abnormal x-ray report, which hints at the limited usefulness of this investigation in the actual management of patients presenting with nasal trauma. It is recommended that training for GPs focuses on carrying out an appropriate assessment of patients and being more confident in diagnosing nasal bone fractures based on history-taking and a comprehensive clinical examination. This will help to minimize unnecessary radiographic investigations.

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