Out-of-hours maxillofacial trauma surgery: a risk factor for complications?

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Abstract. Recent literature from general and orthopaedic surgery as well as anaesthetic viewpoints has identified that operations performed outside normal work hours pose potential risks for both patients and healthcare workers. This is in contrast to the increasing pressure for 24 h surgical availability for the public and the desire to reduce waiting times for patients. Further, there is evidence of the effects of fatigue on reducing performance. The authors aim to compare outcomes of maxillofacial trauma surgery performed in and out of normal work hours. Retrospective analysis was carried out on all maxillofacial trauma surgery under general anaesthesia at a tertiary referral hospital over a 14-month period. Outcomes of patient mortality, injury severity, patient demographics and operation duration were analysed with reference to two groups: in-hours (0800–1700 Monday to Friday) and out-of-hours (1700–0800 Monday to Friday as well as all operations performed Saturday and Sunday). 134 patients/procedures met the inclusion criteria, 53 out-of-hours and 81 in-hours. A statistically significant ($p = 0.05$) higher complication rate (13%) was found in the out-of-hours cases compared to the in-hours cases (4%). The potential implications for this result on the need for increased availability of dedicated in-hours maxillofacial trauma operating lists at major hospitals are discussed.

Keywords: Maxillofacial trauma; Out-of-hours; Complications.

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Recent literature from general and orthopaedic surgery as well as anaesthetic viewpoints has identified that operations performed outside normal work hours pose potential risks for patients and healthcare workers^{1–4}. This is in contrast to the growing demand for emergency theatre time out of normal working hours⁵ to limit waiting times for the public. In New South Wales, Australia, recent guidelines are available that assist in scheduling of emergency sur-

gery⁶. The overall aim of such guidelines is to limit adverse events for patients and healthcare workers, and decrease the economic burden that is associated with performing non-elective surgery after hours. Much evidence exists detailing the effects of fatigue on reducing performance⁷. There is suggestion that the most effective method of reducing this risk in surgery is to eliminate surgery performed after hours unless absolutely necessary².

The majority of maxillofacial trauma surgery seen at the authors' institution is non-urgent, yet a large proportion is performed out of normal work hours due to the limited availability of in-hour theatre time. Theoretically, operating on these cases out-of-hours could have implications on treatment outcomes. The authors aim to compare outcomes of maxillofacial trauma surgery performed in- and out-of-normal work

hours with particular emphasis on post-operative complications.

Materials and Methods

After receiving hospital approval to access electronic records, a 14-month (January 2009–March 2010) retrospective analysis of all maxillofacial trauma surgery under general anaesthesia at a tertiary referral trauma centre in the Australian Capital Territory, Australia was carried out. Data collected included: age; gender; medical co-morbidities; mechanism of injury; a severity score of injury; time from injury to operation; type of operation; preoperative complications; intra-operative complications; postoperative complications; indigenous status; presence or absence of consultant; operation duration; operation start time and finish; date of operation. The Maxillofacial Injury Severity Score (MFISS) as described by Zhang et al.⁸, was available for all but three of the patients from a pre-existing audit of all maxillofacial trauma patients from this hospital. Registrars, in addition to one of two consultants, performed operations and this was recorded as Consultant A present, Consultant B present or registrar only. Where patients had multiple procedures, their definitive, corrective, maxillofacial trauma surgery was used for data collection. For example, some patients had a tracheotomy performed as a stabilising procedure and an open reduction, internal fixation (ORIF) of facial fractures at a later date. In such a scenario, the ORIF surgery data were used for the analysis. Operations were classified as within normal working hours (in-hours) between 0800 and 1700 Monday to Friday and as out-of-hours between 1700 and 0800 Monday to Friday as well as all times Saturday and Sunday. Complications were recorded as pre-, intra- or postoperative. Complications were for a period up to 6 weeks post-operatively from clinical records of follow-up appointments.

Complications were recorded as documented in clinical notes and later classified as minor or major. Minor complications included paraesthesia, persistent diplopia not requiring further surgery, pain not requiring further surgery, non-specific headaches, and other minor issues not requiring any additional medical or surgical management. Major complications were all those requiring another admission, or corrective treatment, including under local anaesthetic, general anaesthetic or by another specialist such as an orthodontist in the case of malocclusion. Data were entered into SPSS (SPSS Inc.,

Chicago, IL, USA) for statistical analysis. In addition to descriptive statistics, logistic regression was used to examine correlates with major complications. Odds ratios and 95% confidence intervals, along with *p* values are presented. A two-block method of entry was used. The first block included potential confounding factors: age; gender; indigenous status; severity; duration; consultant; intra-operative complication; age of injury. The second block examined the contribution of in- or out-hours of surgery time. The probability of inclusion was 0.05 a probability of 0.1 was used for removal. A forward likelihood ratio method was used.

Results

138 patients were identified in the search. Of these, 134 were used in the statistical analysis. Those for whom MFISS was not available were excluded. There was one death in the in-hours group that was

excluded. This patient was a multi-trauma case from a motor vehicle accident. He underwent ORIF of a mandible fracture at an early stage in his overall management but succumbed to brain injury sustained during his accident and life-support was stopped at 1 month post-injury. He had no identifiable complications related to his maxillofacial surgery procedure up until the time of death. The overall cohort showed a male predominance and age pattern consistent with other maxillofacial trauma epidemiological studies⁹. Table 1 demonstrates the similarities between the two groups. Descriptive statistics further demonstrate the similarities in demographics between the in- and out-of-hours groups (Tables 2 and 3). Table 4 highlights location of injuries for the entire patient cohort. Registrar-only was present for 11 cases, of which none had any reported intra- or postoperative complications. In the out-of-hours group there were 7 (13%) major complications and 18 (34%) minor

Table 1. Comparison of in- and out-of-hours groups.

	In-hours	Out-of-hours
Number	81	53
Males	72 (89%)	44 (83%)
Females	10 (12%)	9 (17%)
Existing co-morbidities	38 (47%)	25 (47%)
Indigenous	3 (4%)	3 (6%)
Consultant A	49 (63%)	29 (37%)
Consultant B	26 (59%)	18 (41%)

Consultant A and B percentages represent the proportion of their cases for each group. Means were calculated using SPSS (SPSS Software Inc., Chicago, IL).

Table 2. Descriptive statistics (in-hours).

	Minimum	Maximum	Mean	Std deviation
Age	1	71	27.23	13.214
MFISS	1	45	9.93	7.914
Duration (min)	1	361	69.26	58.318
Age of injury (days)	0	20	5.96	4.462

Table 3. Descriptive statistics (out-of-hours).

	Minimum	Maximum	Mean	Std deviation
Age	4	69	27.64	12.660
MFISS	1	42	11.85	8.422
Duration (min)	16	185	77.51	44.912
Age of injury (days)	0	35	5.06	6.701

Table 4. Distribution of operation types between in- and out-of-hours groups.

Operation type	In-hours	Out-of-hours
Closed reduction; laceration repair; dentoalveolar	28 (35%)	19 (36%)
Orbit Reconstruction	9 (11%)	2 (4%)
Mandible ORIF	31 (38%)	19 (36%)
Zygoma ORIF	9 (11%)	8 (15%)
Lefort I, II, III or multiple site ORIF	3 (4%)	5 (9%)
Frontal Sinus ORIF	2 (2%)	0

Percentage represents proportion of each groups total.

Table 5. Details of each patient assigned to the major complication outcome group.

Patient	Group	Operation type	Postoperative complication
1	Out-of-hours	ORIF mandible	Malocclusion requiring orthodontics
2	Out-of-hours	Open zygoma reduction	Severe infection requiring admission and intravenous antibiotics
3	Out-of-hours	ORIF mandible	Malocclusion and anterior open bite requiring repeat operation
4	Out-of-hours	ORIF mandible	Malocclusion requiring admission for repeat operation
5	Out-of-hours	ORIF mandible	Infected wound site requiring repeat operation for washout/removal of hardware
6	Out-of-hours	ORIF mandible	Infected wound site require readmission for intravenous antibiotics
7	Out-of-hours	ORIF zygoma	Return to theatre for removal of hardware causing soft tissue trauma
8	In-hours	ORIF mandible	Malocclusion/inadequate reduction requiring repeat operation
9	In-hours	ORIF mandible	Wound infection requiring further surgical procedure
10	In-hours	Orbital floor recon	Wound scarring requiring further surgical procedure

complications. Comparatively, in the in-hours group there were 3 (4%) major complications and 24 (30%) minor complications. The specific detail of each patient assigned as having a major complication is listed in Table 5. There was a statistically significant increase in major complications in the out-of-hours group compared to the in-hours group (OR 4.2 CI 1–18, $p = 0.05$) after adjusting for age, gender, duration, consultant, MFISS, intra-operative complications, age of injury and indigenous status. There was no significant difference in minor complications between the in- and out-of-hours groups.

Discussion

This single centre, retrospective analysis identifies a trend that perhaps operating out-of-hours for maxillofacial trauma surgery exposes patients to a higher rate of complications. Despite small numbers of patients, the authors had similar groups for comparison and investigated the impact of multiple confounding factors (including injury severity) on the result.

There has been much discussion at both a national and international level regarding the effective use of emergency theatre time in public hospitals^{5,6,10}. Indeed, there appears to be a growing demand for emergency theatre time out of normal working hours⁵. In some states of Australia, recent guidelines are available that assist in scheduling of emergency surgery⁶. The overall aim of such guidelines is to limit adverse events for patients and healthcare workers, and decrease the economic burden that is associated with performing non-elective surgery after hours. Evidence exists in general and orthopaedic surgery literature, that suggests limiting the amount of emergency surgery performed out of normal hours, has no significant detriment to patient outcomes^{1,11}. Indeed, it has been suggested that reducing operating at night may improve the capacity of the acute

surgical system to deal with truly urgent cases².

This retrospective single centre study clearly demonstrates a statistically significant higher complication rate amongst maxillofacial trauma surgery performed out-of-hours compared with in-hours surgery. This is an alarming finding that is consistent with other recent surgical and anaesthetic literature. The result highlights the need for additional dedicated maxillofacial non-elective trauma lists at major hospitals to ensure non-critical cases are not operated on out-of-hours, as has been suggested by other surgical disciplines¹².

Although achieving a statistically significant result, the authors recognise several limitations of this research. The short-term nature of assessing complications at 6 weeks postoperatively was felt to be necessary in this retrospective analysis as long-term follow-up appointments for many of these patients were rarely attended. The effect of this short follow-up, as expected, yielded a higher number of complications that often resolve over a longer period of time, such as paraesthesia, persistent areas of diplopia, and scarring. This was a primary reason for grouping these complications into a minor category. Another reason was that these complications often existed preoperatively in the analysis, and retrospectively, it was impossible to determine if they were only apparent as true postoperative complications; that is, caused by the surgical procedure and not the initial injury. These types of complications would be more accurately assessed in future prospective trials. It is important to note that the analysis is based on maxillofacial trauma surgery alone. This subset of maxillofacial surgery is often non-urgent in nature, though it may be urgent in some cases, such as control of acute haemorrhage or airway compromise. It should also be noted that the definitive facial injury treatment was used for data collection, as this is often delayed until initial stabilisation

procedures have occurred, and therefore is non-urgent in nature. While patients were excluded because MFISS being unavailable, it is important to note that none of them had a major complication reported in the initial data collection. Their exclusion has no bearing on altering the outcome of significance of the statistics. The majority of complications in this series related to postoperative infection or malocclusion. 7 of 10 patients who presented with complications of treatment had corrective surgery for mandible fractures. That four of these cases related to malocclusion may be of interest as it is arguably the most sensitive measure of successful reduction, and this is something that may be compromised with operator fatigue. In this series, in-hours infection rate (3%) and return to theatre (10%) for mandible fractures was similar to that of recent literature^{13,14}. This further demonstrates the strength of the data. Without question, further prospective, multicentre trials would improve understanding of the implications on patient morbidity, as well as costs to healthcare systems of operating on non-critical cases outside normal work hours.

Declarations

Competing interests: None declared.

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Ethical approval: Not required.

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