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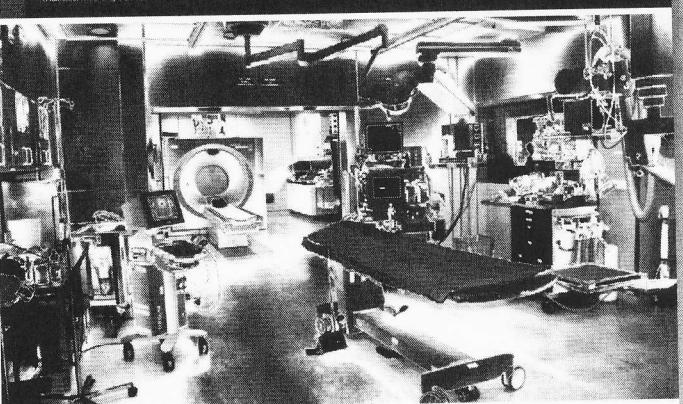
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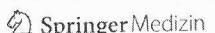
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## Chronic pain and its impact on quality of life following a traumatic rib fracture

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### Abstract

**Purpose** Traumatic rib fractures account for 7–40 % of trauma admissions and most of them heal spontaneously and do not contribute to disability. The prevalence of chronic pain and its impact on quality of life following a traumatic rib fracture has not been studied adequately.

**Methods** A retrospective review of electronic medical records of all the traumatic rib fracture admissions from January 2007 to December 2008 was conducted. This was followed up with a brief telephonic survey of the following questions: (1) Do you have pain following the trauma? (2) If YES, how severe is your pain from a score of zero to ten? (3) Does the pain affect your life style? (4) Does the pain affect your work? (5) Do you need to take regular pain medications?

**Results** One hundred and two patients responded to the survey and 23 patients (22.5 %) complained of chronic persistent pain. In patients with pain, six patients (26 %) had chronic pain that required regular use of analgesics, eight patients (35 %) complained of impairment of work life, and three patients (13 %) complained of impairment of personal quality of life. Chronic pain was not related to age, number of ribs fractured, flail chest, hemothorax and/or pneumothorax, chest tube insertion, or Injury Severity Score (ISS).

**Conclusion** This study confirms the high incidence of chronic pain after a traumatic rib fracture. While the majority of the patients can manage this pain without interference

of their quality of life, a few do suffer from life style/work interference and may have to resort to regular analgesic usage.

**Keywords** Chronic pain · Rib fracture · Thoracic trauma

### Introduction

Chest trauma accounts for up to 15 % of trauma admissions [1]. Blunt thoracic trauma is more common in comparison to penetrating chest trauma and is often associated with bony thoracic injuries [2]. Traumatic rib fractures contribute significantly to pleuro-pulmonary morbidity and mortality. Acute post-traumatic pain control is an important concern and is usually dealt with by a multidisciplinary team approach at busy trauma centers. Chronic pain following a traumatic rib fracture can be disabling and can have a large psycho-socio-economic impact for a health-care system. The incidence of chronic pain following a traumatic rib fracture is not widely published. We reviewed our institutional experience to study the impact of chronic pain following a traumatic rib fracture.

### Methods

Tan Tock Seng Hospital is a busy tertiary care hospital with 1,300 beds and handles the maximum number of acute trauma admissions in Singapore. Our hospital manages more than 1,000 trauma cases annually, with 40 % of cases having an Injury Severity Score (ISS) of more than 16 [3]. The majority of hospital admissions are for blunt thoraco-abdominal trauma secondary to road traffic accidents. We reviewed our trauma registry database for the years

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2007–2008 and identified patients having a traumatic rib fracture. The majority of patients had other concomitant injuries to other body parts. The diagnosis of rib fracture was made objectively upon the reporting of the imaging by an accredited radiologist. Chronic pain is defined as pain at the site of injury that is persistent for more than 12 months duration. We designed a simple telephonic questionnaire (Table 1) to study the incidence of chronic pain and its impact on the quality of life. Medical students were taught on the usage of the questionnaire and were assigned the task of making phone calls to patients. The telephonic survey was conducted in the year 2009 so that all the patients were interviewed at a minimum interval of 1 year following traumatic rib fracture. A telephone call was made to each patient on four separate occasions on two different telephone numbers over three separate days with at least 1 day being a weekend. If a patient was unable to be contacted, then no further phone calls were made. If a patient did not have any pain at the site of thoracic injury, no further questions were asked and the phone call was ended. When a patient complained of the presence of pain, then a full questionnaire was undertaken. In patients with bilateral and multiple fractures, the patient was instructed to focus on the most painful side and site of injury. The most painful site was used for data collection purposes. In patients complaining of pain at other sites, e.g., limbs, this was not documented. In patients who do not work, household chores were regarded as 'work'. The numeric rating pain score scale was used and a telephonic description was provided by the trained medical student to the patient. The score was charted from zero (no pain) to ten (intolerable pain). In the instances of patients providing a reply in ranges, the higher value of the range was recorded, e.g., when a patient replied a pain score of three to four, the pain score was recorded as four. The relevant demographic and clinical data was recorded in an MS Excel spreadsheet. The collected data were subsequently analyzed with Pearson's Chi-square test and Fisher's exact test, where appropriate. The level of significance was defined as  $p \leq 0.05$ .

## Results

Three hundred and eleven patients were admitted with a radiologically proven traumatic rib fracture over the study period of 2 years. One hundred and two patients (32.8 %)

**Table 1** Questionnaire used in the survey of patients

- Do you have pain following the trauma?
- If YES, how severe is your pain from a score of zero to ten?
- Does the pain affect your life style?
- Does the pain affect your work?
- Do you need to take regular pain medications?

responded to the survey. The majority of the patients were male (71.6 %), of Chinese race (73.5 %), and the median age was 56 years (range 19–84 years). Sixty-eight (66.7 %) patients had a road accident and 30 (29.4 %) patients sustained a fall causing rib fracture. Fifty-two (50.9 %) patients had three or less ribs fractured, 43 (42.2 %) patients had more than three ribs fractured, and seven (6.9 %) patients had flail chest. Six patients sustained bilateral fractures. Forty-six (45.1 %) patients sustained either hemothorax or pneumothorax or both. Sixty-eight (66.7 %) patients had a chest tube inserted. The mean ISS of all patients was 20.1 and 63 (61.8 %) patients had an ISS of more than 15. Sixteen patients required ventilator support in the surgical intensive care unit. Twenty-three (22.5 %) patients complained of persistent chest pain, with a median pain score of three. Table 2 describes patients who have persistent pain at the site of injury. In patients with pain, six (26 %) patients had chronic pain that required the regular use of analgesics, eight (35 %) patients complained of impairment of work life, and three (13 %) patients complained of impairment of personal quality of life. There was no statistical significant difference in the persistence of chronic pain in relation to the age, sex, or race of the patients (Table 3). The mechanism of injury, laterality, number of rib fractures, flail chest, hemothorax and/or pneumothorax, chest tube insertion, and ISS were also not related to the persistence of chronic pain (Table 3).

## Discussion

Rib fracture is a common result of blunt thoracic trauma. The true incidence of rib fracture following a blunt thoracic trauma may be unknown, as not all rib fractures are detected on chest films. Traumatic rib fractures are not only associated with acute injury-related pain, but are also associated with pleuro-pulmonary complications with a potential for mortality. There are very few specific reports on rib fracture-related pain and disability [4]. Pain is a subjective phenomenon and objective measurement is difficult. Most of the trauma-related pain is also temporary in

**Table 2** Patients suffering from chronic pain

Chronic pain sufferers, $N = 23$	
Total number of patients, $N = 102$	
Gender	Male: 14 (60.9 %), female: 9 (39.1 %)
Pain score	Median 3, mean 3.7
Life style affected	3 (13 %)
Work affected	8 (35 %)
Pain medication	6 (26 %) <sup>a</sup>

<sup>a</sup> One patient resorted to traditional Chinese medicine (TCM) for analgesia control

**Table 3** Demographics, injuries, and associated complications

	All patients	Presence of pain >12 months after injury	p-value	
			Yes (%)	No (%)
<b>Age (years)</b>				
11–30	18	17	83	0.912
31–50	23	26	74	
51–70	44	23	77	
71–90	17	23	77	
<b>Sex</b>				
Male	73	19	81	0.202
Female	29	31	69	
<b>Race</b>				
Chinese	75	25	75	0.309
Malay	16	25	75	
Others	11	0	100	
<b>Mechanism of injury</b>				
Road traffic accident	68	24	76	0.750
Fall	30	23	77	
Other	4	0	100	
<b>Laterality</b>				
Unilateral	96	22	78	0.615
Bilateral	6	33	67	
<b>Number of fractures</b>				
<3	52	21	79	0.412
≥3	43	21	79	
Flail chest	7	43	57	
<b>Pneumothorax/hemothorax</b>				
Yes	46	20	80	0.635
No	56	25	75	
<b>Chest tube</b>				
Yes	68	25	75	0.461
No	34	18	82	
<b>Injury Severity Score</b>				
1–15	39	23	77	0.763
16–30	44	20	80	
31–45	17	29	71	
46–60	2	0	100	

Overall pain rate 23 %

nature. Acute pain is dealt with a multidisciplinary approach with the liberal use of patient-controlled analgesia and epidural analgesia. Chronic pain following a traumatic rib fracture has not been widely published. In our experience of managing thoracic injuries at our trauma center, it is not uncommon to encounter a patient with persistent chronic pain visiting the outpatient clinic asking for analgesia or requesting for prolongation of his/her medical leave and, in some instances, enquiring about

worker compensation details. This encouraged us to review our trauma registry database and study the impact of chronic pain.

Acute minor thoracic injuries can be managed as outpatient care and there are no clear guidelines on posttraumatic analgesia prescription. In a recent audit of three university hospital emergency departments' practice, it is evident that up to 10 % of patients develop delayed complications within 14 days of trauma and up to 19 % of patients have unscheduled visits requesting analgesia [5]. Rib fractures are a marker of the severity of injury [1]. Age and the number of ribs fractured are determinants of morbidity and mortality [6, 7]. Holcomb et al. [8] reported a two-fold increase in the mortality rate in patients above 45 years of age. Liman et al. [9] found high morbidity and mortality rates in those over 60 years of age. There are no known determinants of the persistence of chronic pain following a traumatic rib fracture. After a comprehensive review of current published evidence, we hypothesized that (a) more than three rib fractures, (b) bilateral rib fractures, (c) elderly patient, (d) hemothorax and/or pneumothorax, (e) chest tube insertion, and (f) ISS greater than 15 may be associated with persistent chronic pain and, hence, needs evaluation.

A telephonic medical questionnaire was designed to study our hypothesis. We designed a simple questionnaire to keep the phone conversation short and also to cover the core information relevant to chronic pain and its impact. Five questions were selected after a review of the RAND SF-36 questionnaire that has been validated previously for acute pain following a traumatic rib fracture [4].

One hundred and two patients out of a total of 311 patients responded to the questionnaire. Relocation, change in contact details, holiday, and demise were attributed to the failure of telephonic consultation. Many patients being foreign migrant workers have relocated. In the era of mobile communication revolution, some patients have also changed their contact details and these have not been tabulated in the registry database, proving the limitation of a registry. The majority of the victims were Chinese males with a history of road accident leading to blunt thoracic injury. Blunt thoracic injury and road accident is a disease of the young productive age group population. The median age of our patients was 56 years (range 19–84 years). Our results echo the reports from other centers as road accidents being the most common cause of blunt thoracic trauma and rib fractures. We did not encounter any penetrating injury causing a rib fracture in our current series. More active life style and high use of motor vehicles among the male patients make them more vulnerable.

Approximately half of the patients sustained more than three rib fractures and flail chest. Two-thirds of patients required a chest tube insertion. Sixty-three (61.8 %)

patients had an ISS of more than 15. High ISS is the predictor of morbidity and mortality following any trauma. Our hospital's high ISS is comparable to others' and reflects the severity of the trauma patients having rib fractures [1, 6, 10].

Persistent pain and debility can have disastrous socio-economic effects. Chronic pain has been defined inconsistently by various groups and associations [11, 12]. We decided to define chronic pain as persistent posttraumatic pain for 12 months (or more) in order to incorporate all the definitions that define chronic pain by duration. Twenty-three (22.5 %) patients complained of persistent chronic pain.

The reason for chronic pain may vary from anatomical causes to psychosocial reasons. In one study, pain accounts for 20 % of all outpatient visits and 12 % of all prescriptions [13]. While some patients may experience loss of work hours, anxiety, depression, sleep deprivation, and detrimental effect on interpersonal relations, some patients may accept this as a part of their life and suffer in silence or become reliant on regular analgesic use—i.e., abuse. Inadequate acute pain management may result in a chronic pain state with the incorporation of underlying emotional, behavioral, and psycho-social factors. The aim of our study was not to study the inadequacy of acute pain relief. We have a comprehensive multidisciplinary trauma care and acute pain management service. It is also a routine practice to provide analgesic prescription for all trauma patients upon discharge and, hence, it is unlikely that inadequate acute pain management would impact the incidence of chronic pain. All our patients are encouraged to carry out deep breathing exercises and counseled that trauma-related pain may take up to 6 weeks and sometimes up to 3 months to resolve.

There have been reports on a higher incidence of acute pain with more than three rib fractures, but we did not find this to be significant for persistent chronic pain. We postulated that hemothorax and/or pneumothorax would indicate severe impact injury and may have a higher incidence of chronic pain, but this was not found to be of any statistical significance. The insertion of chest tubes and ISS more than 15 were also not found to be related to a higher

incidence of chronic pain. This means that the physiopathology of chronic pain is different from acute pain.

Kerr-Valentic et al. [4] reported a mean pain score of one at 120 days. Our data reflects the higher incidence of chronic pain, with a median pain score of three after 1 year. This may be due to the relatively small sample of 40 patients in their study, six of whom were discharged from the emergency department and 18 patients had two or less rib fractures. In our study, three out of seven patients with flail chest had chronic pain. We do not offer routine surgical rib fixation for our flail chest patients. There are two randomized trials establishing the benefit of surgical rib fixation to reduce the length of intensive care stay, duration on mechanical ventilation, duration of hospitalization, earlier return to work, and less chronic pain [14, 15]. These procedures are restricted to a highly select group of patients with massive chest wall deformity, inability to wean off the ventilator, and severe pulmonary complications, despite adequate analgesia support. Rib fixation surgery can also have potential complications related to hardware. Lardinois et al. [16] reported 11 % reoperation rate to remove the stainless steel plates due to chronic pain secondary to the plates used for rib fixation.

In patients with pain, all three (13 %) patients who affirmed that their life style was affected also had work-related difficulties. Eight (35 %) patients complained of work-related issues and the most common problem encountered was discomfort when lifting heavy weights. The patients confirmed that this was purely related to the 'chest' discomfort and not related to the injury of other body parts. In patients with pain, six (26 %) patients needed regular analgesia to control chronic pain. The demography and clinical profile of these six patients is summarized in Table 4. There was no significant difference in the demography and clinical characteristics of these six patients.

This is a retrospective study from a database and, hence, there are inherent limitations in this study. The response rate to the telephonic questionnaire is one-third. A substantial number of foreign migrant workers have not been able to be contacted due to changes in contact details. This is the group which is more likely to be in the productive

**Table 4** Patients requiring regular analgesics

Number	Age (years)	Sex	Mechanism	ISS	≥3 rib fractures	Hemothorax and/or pneumothorax	Length of stay (days)
1	71	F	RTA	34	No	Yes	21
2	56	F	RTA	9	No	No	3
3	77	M	RTA	12	No	No	4
4	59	M	RTA	5	No	No	3
5	43	M	RTA	20	Flail chest	No	2
6 <sup>a</sup>	40	M	RTA	20	Yes	Yes	4

<sup>a</sup> This patient resorted to regular traditional Chinese medicine (TCM) usage for pain control

phase of life and would be affected the most by the presence of chronic pain. The burden of chronic pain is likely to be underestimated due to the outpatient management of minor blunt thoracic injuries and not all fractures being evident on chest radiograph. Also, the potential contribution of injuries at other body parts to the outcome of thoracic injury would be a confounder.

In summary, chronic pain following a traumatic rib fracture is a real burden, with an incidence of 22.5 %. There are no known predictors for chronic pain and the optimal management of acute pain does not reduce the incidence of chronic pain. The effect of chronic pain on quality of life and work life is minor, but given the burden of rib fracture disease, this is one of the major public health and socio-economic concerns. A multimodal approach to address chronic pain is recommended for this group of patients. All rib fracture patients should be followed up for at least a year in order to identify and manage the patient who shall suffer from chronic pain.

**Conflict of interest** None.

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