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THE OPTIMAL PHYSIOTHERAPEUTIC APPROACH TO PENETRATING STAB WOUNDS OF THE CHEST

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INTRODUCTION

Penetrating stab wounds of the chest are among the most common injuries seen in the casualty department at Hillbrow Hospital, Johannesburg. Out of a total number of 18,393 patients admitted to the hospital during a five year period (23 February 1988 to 9 January 1993) 1,650 male patients were admitted with stab wounds of the chests. Of these patients, 1,255 received intercostal drains, while the rest (395 patients) were managed without intercostal drainage. The average age was 29.82 (max 88 years; min 15 years). The average number of days hospitalised for the group that received intercostal drains was 4,72 days (max 170 days; min 0 days). The patients who were managed without intercostal drains had spent an average number of 5,27 days in hospital (max 113 days; min 0 days). The fact that patients who were managed without intercostal drains had a longer hospital stay compared to those managed with intercostal drainage was very interesting.

Over the past decades radical changes have taken place in the management of penetrating injuries of the chest. Treatment has swung from an aggressive surgical approach with a high thoracotomy rate to a more conservative policy using drainage by tube and observation. Hippocrates was the first to consider drainage of the pleural space when he described incision, cautery and metal-tubes to drain empyemas¹. During World War I, there was some debate over the desirability of evacuating blood in the pleural space, those opposed arguing the accumulating blood tamponades the bleeding. This opposition gradually faded after the war, and by the time of World War II it was the method of evacuating blood that became controversial².

Current practice is individualised treatment of the particular case, using intercostal tube drainage, thoracotomy or thoraco-

OPSOMMING

Penetrenderende steekwonde van die toraks is van die mees algemene beserings wat in die ongevalle afdeling by Hillbrow Hospitaal in Johannesburg gesien word.

Opinies met betrekking tot die chirurgiese hantering van pasiënte met hemopneumotorakse verskil.

Die doel van hierdie studie was om te bepaal of daar 'n verskil in resultate sal wees tussen pasiënte wat longfisioterapie onmiddellik na inplasing van die inter-kostale drein ontvang, en daardie pasiënte wat longfisioterapie later ontvang.

Gedurende 'n vergelykende studie is ses-en-twintig manlike pasiënte met penetrenderende steekwonde van die toraks, ewekansig tydens opname by die Hillbrow Hospitaal aan een van twee groepe toegeken. Die pasiënte in Groep I het longfisioterapie onmiddellik na inplasing van die interkostale drein gekry, terwyl pasiënte in Groep II longfisioterapie nege tot twaalf ure later gekry het. Gemiddelde duur van interkostale dreinasie in Groep I was 40,00 ure en in Groep II 65,92 ure. Pasiënte in Groep I het 'n gemiddelde duur van 43,96 ure hospitaalverblyf gehad, terwyl pasiënte in Groep II 'n gemiddelde hospitaalverblyf van 77,53 ure gehad. Die prevalensie van pasiënte met piroksie was ook betekenisvol minder in Groep I as in Groep II. Hierdie studie dui daarop dat die aggressiewe protokool van longfisioterapie onmiddellik na inplasing van die interkostale drein definitiewe voordelige resultate oplewer.

Sleutelwoorde: penetrenderende steekwonde, fisioterapie.

abdominal exploration as indicated³. It is known for a long time that the majority of penetrating wounds of the chest can be successfully treated with an intercostal chest tube, thoracotomy being reserved for specified cases^{4,5,6,7,8,9}. Several authors in their studies on haemopneumothoraces mention that patients received chest physiotherapy during their stay in hospital, but no treatment details on the time

SUMMARY

Penetrating injuries to the chest are among the most common injuries seen in the casualty department at Hillbrow Hospital, Johannesburg.

Opinions regarding the surgical handling of patients with penetrating chest trauma continue to differ.

The purpose of this study was to determine whether there would be a difference in outcome in patients who receive chest physiotherapy immediately after insertion of the intercostal drain versus those patients who receive chest physiotherapy nine to twelve hours later. In an effort to optimise the physiotherapy management of patients with penetrating stab wounds to the chest, a comparative study was conducted at Hillbrow Hospital, Johannesburg. Twenty six male patients between the ages of eight-teen to thirty years were randomly allocated to one of two groups on admission to the Hospital.

The patients in Group I received chest physiotherapy immediately after insertion of the intercostal drain while patients in Group II received chest physiotherapy nine to twelve hours later. Mean duration of time of intercostal drainage in Group I was 40 hours and in Group II 65,92 hours. Patients in Group I had a mean hospital stay of 43,96 hours, while patients in Group II had a mean hospital stay of 77,53 hours. The prevalence of patients with spiking temperatures was also significantly lower in Group I than in Group II. This study suggests that the protocol of an aggressive approach of immediate chest physiotherapy in these patients has definite beneficial results.

Key words: Penetrating injuries, physiotherapy.

that chest physiotherapy commenced or the format of chest physiotherapy, are given¹⁰.

The majority of these patients are admitted during the evening or at night and the normal procedure at most hospitals is that they are only treated the following day when the physiotherapists come on duty.

Beneficial results (shorter duration of hospitalisation, shorter intercostal drainage times and a lower prevalence of complications) as a result of early chest physiotherapy commencing on insertion of the intercostal drain, were described in patients with stab wounds of the chest in 1973¹¹.



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With increasing pressure for the availability of surgical hospital beds and resources, it is important to optimise the effectiveness of chest physiotherapy in patients with haemopneumothoraces due to penetrating stab wounds to the chest.

The aim of this study was to determine whether there would be a difference in outcome in patients who receive chest physiotherapy immediately after insertion of the intercostal drain versus those patients who receive chest physiotherapy nine to twelve hours after insertion of the intercostal drain.

Comparisons between the two groups were made, using the following parameters:

- Duration of intercostal drainage.
- Duration of hospitalisation.
- Prevalence of spiking temperatures. (Prolonged intercostal drainage times are associated with increased infection rates and morbidity¹⁰).

PATIENTS AND METHODS

This study was conducted at the Hillbrow Hospital, Johannesburg over a five month period (January to May 1993). Twenty six male patients between the ages of 18 to 30 years, with unilateral penetrating stab wounds to the chest were included in this study. The patients participating in this study were all haemodynamically stable on admission. Penetration was clinically assessed and confirmed radiologically before the patient was admitted to the series. All patients had an inspiratory chest radiograph taken on admission which was repeated after insertion of the intercostal drain and at intervals dictated by the clinical progress of the patient. All patients with pneumothoraces with a rim of intrapleural air from the lung border to the inside of the thoracic wall at the level of the anterior bony end of the third rib, measuring 1,5 centimetres or more wide and all patients with fluid levels up to the angle of the ninth rib or above, as assessed radiographically, were included in this study. Radiological assessment of chest radiographs were done during the course of this study by the same radiologist.

Patients who were admitted with tension pneumothoraces, sucking chest wounds, previous chest trauma, other injuries, eg. head injuries and cardiac injuries or patients on antibiotics for pre-existing infections for unrelated disease, were excluded from this study. Patients who were admitted to hospital more than 8 hours after the stabbing were also excluded.

All patients had intercostal drains inserted in the fifth intercostal space in the midaxillary line in order to have a homogenous group of patients. All patients were given tetanus toxoid and broad spec-

trum antibiotics. Sufficient analgesia was provided by paracetamol with or without codeine or pethidine, to enable patients to breathe deeply and cough without undue discomfort. The protocol for this study was accepted by the Committee for Research on Human Subjects.

After informed consent had been obtained patients were randomly allocated to one of two groups, depending on whether a red or a blue card was drawn from an envelope. Group I received chest physiotherapy immediately after insertion of the intercostal drain. Group II received chest physiotherapy nine to twelve hours after insertion of the intercostal drain. After initial treatment, both groups received chest physiotherapy twice daily until removal of the intercostal drain. Physiotherapy for both groups was standardised.

SPECIFIC ROUTINE ADOPTED FOR PATIENTS IN BOTH GROUPS

SITTING:

- Unilateral lateral costal breathing, posterior basal breathing, diaphragmatic breathing.
- Both hands behind the head, bend trunk forward (flexion) and touch knees with forehead. Combine with inspiration and expiration. Repeat 10 times.
- Arms at side, side flexion of trunk to both sides. Repeat 10 times to both sides. If fluid drains in one of these positions, keep position and cough.
- Arms bent, right elbow moves to touch left knee and vice versa. Repeat 10 times to both sides.
- Coughing.
- Brisk walking on the spot – lift knees to the level of hips. One minute.
- Deep breathing exercises. Unilateral lateral costal breathing, posterior basal breathing and diaphragmatic breathing.
- Coughing.

STANDING:

- Arms stretched above head, inspiration and then trunk flexion so that hands touch the floor whilst patient exhales. If fluid drains in this flexed position, keep position and combine with coughing and deep breathing exercises. Repeat 10 times.
- Arms at sides, lateral flexion to both sides. If fluid drains in this lateral flexed position, keep position and combine with coughing and deep breathing exercises. Repeat 10 times.
- Arms yard. Circular movements of the arms. Big circles – Repeat 10 times. Small circles – repeat 10 times.
- Deep breathing exercises – unilateral lateral costal breathing, posterior basal breathing and diaphragmatic breathing.

- Coughing
- Feet astride, arms yard, bend and touch right foot with left arm, return to starting position and then vice versa. Repeat both sides 10 times.
- Brisk walking on the spot (2 minutes). Brisk walking around in ward (2 minutes). Running up stairs (2 minutes). Do this exercise depending on what the patient can manage.
- Coughing.

Trunk exercises were done because changes in posture tend to move the intrapleural contents towards the site of the drain which had been inserted in the fifth intercostal space in the midaxillary line. These exercises helped fluid that lay basally in the pleural space to be mobilised to the site of the drain.

Doctors who were responsible for the decision whether to remove the intercostal drain or not, did not know to which group the patients had been assigned to.

The criteria for the removal of the drain were the following:

- Clinical assessment that the lung had re-expanded and, if fluid had been present initially that there was evidence of only a small amount of remaining fluid.
- Radiography revealed that the lung was expanded and/or that the fluid had been drained to a minimum.
- Cessation of swinging of the intercostal drain.

The intercostal drain was removed during a Valsalva manoeuvre and the chest radiograph was repeated to confirm radiological expansion of the lung.

On discharge, patients were asked to return to hospital urgently if they experienced any chest problems.

Patients were reviewed clinically and radiologically at the outpatient department within one week after discharge.

STATISTICAL ANALYSIS

In order to analyse the duration of intercostal drainage and duration of hospitalisation, Levene's test for variability was used to compare the two groups and to determine which further tests should be used to determine a significant difference. The separate t-test was used to determine a significant difference with $p < 0,05$ in both cases.

In order to analyse the prevalence of temperatures the Pearson's Chi-square test was used to compare the groups and to determine which further tests should be used to determine a significant difference. Fisher's exact test was used to determine a significant difference with $p < 0,05$.

continued on page 34...



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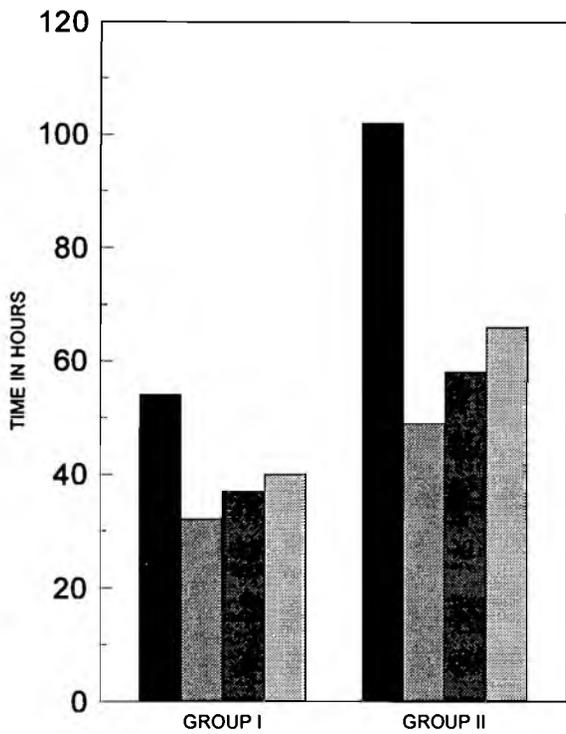


Figure 1. Duration of Intercostal Drainage

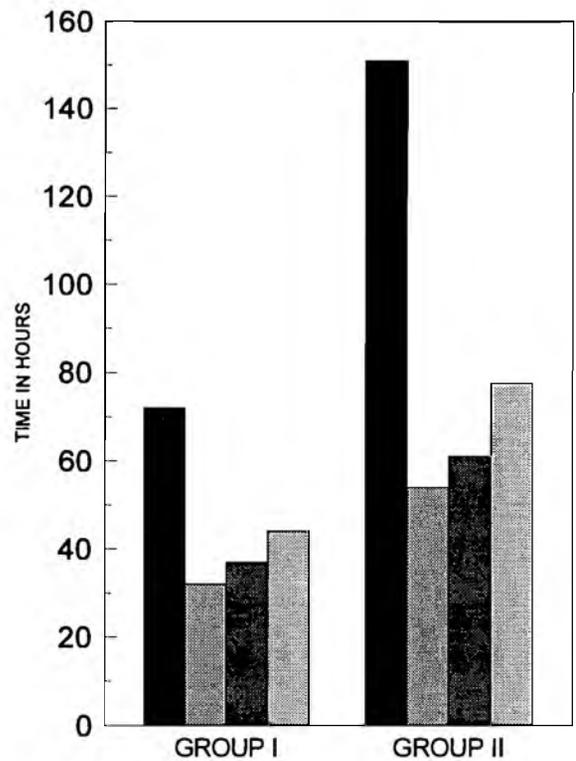


Figure 2. Duration of Hospitalisation

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RESULTS

Duration of intercostal drainage

(See figure 1, page 34)

The maximum length of intercostal drainage in Group I was 54,0 hours with a minimum of 32,0 hours. The median was 37,0 hours (Mean 40 hours; Range 22; SD \pm 7,17).

In Group II the maximum length of intercostal drainage time was 102,0 hours with a minimum of 49,0 hours. The median was 58,0 hours (Mean 65,92 hours; Range 53; SD \pm 16,16).

Levene's test for variability was used for a significant difference with $p=0,05$. Using the separate t-test, there was a significant difference ($p=0,0001$) in intercostal drainage times between the two groups with Group I having significantly shorter intercostal drainage times than Group II. There was no relationship between the duration of intercostal drainage and the age of patients.

Duration of hospitalisation

(See figure 2, page 34)

The maximum length of time spent in hospital in Group I was 72,0 hours with a minimum of 32,0 hours and a median of 37,0 hours (Mean 43,96 hours; Range 40; SD \pm 13,29).

In Group II the maximum length of time spent in hospital was 151,0 hours with a minimum of 54,0 hours. The median was 61,0 hours (Mean 77,53 hours; SD \pm 28,78).

Levene's test for variability was used. Using the separate t-test, there was a significant difference ($p=0,0001$) in the duration of hospitalisation between the two groups, with Group I having significantly shorter periods of hospitalisation than Group II.

There was no relationship between the age of the patients and the duration of hospitalisation.

Prevalence of spiking temperatures

Two patients in Group I and five patients in Group II presented with spiking temperatures within the first twenty four hours after admission. Another three patients in Group II presented with spiking temperatures within the next twenty four hours.

Using Fisher's Exact test (one tail), there was a significant difference ($p=0,0207$) between the groups regarding the prevalence of spiking temperature, with patients in Group I having significantly less spiking temperatures than patients in Group II.

No cases of empyema or wound sepsis were seen in either of the groups.

DISCUSSION

Hillbrow Hospital is a large, busy, academic hospital for patients mainly from Johannesburg city and the surrounding suburbs. The incidence of trauma, including penetrating chest wounds, is high. Penetrating injuries of the chest appear to be frequent in most metropolitan areas, according to Adkins *et al*¹². Milier *et al*¹³ reported that, over a ten year period ending in the 1970s, the number of patients with stab injuries treated in New York City hospital doubled, while bullet wounds to the chest increased by fifteen times.

It is also a perception of the casualty staff at Hillbrow Hospital that the tendency towards gunshot wounds in relation to stab wounds has increased during the past year.

A conservative approach to the management of stab wounds to the chest has evolved over the years^{5,6,14} and this has been the case at the Hillbrow Hospital as well. The aims are to avoid unnecessary thoracotomy, to drain large collections of fluid or air from the pleural space rapidly and efficiently, resulting in an early removal of chest drains, thereby avoiding any complications arising from their prolonged presence.

The aggressive approach of chest physiotherapy immediately after the insertion of the intercostal drain has definite beneficial results. The duration of intercostal drainage in this group of patients was at least twenty four hours shorter than in the group of patients who received physiotherapy nine to twelve hours after insertion of the intercostal drain.

The prevalence of spiking temperatures was also significantly smaller in Group I than in Group II. Due to this fact, the duration of hospitalisation of patients in Group I was on the average 1,4 days shorter than that of patients in Group II. Knottenbelt *et al*¹⁰ in their study on patients with simple pneumothoraces reported a mean hospital stay of twenty two hours duration for non-leakers and forty nine hours for those patients with continuous air leaks.

The patients in this study who received chest physiotherapy nine to twelve hours after insertion of the intercostal drain had a mean hospital stay of 77,53 hours mean. It should be considered that 84,6% of the patients in this group presented with a haemopneumothorax and not just a simple pneumothorax as was the case in the study of Knottenbelt *et al*¹⁰. Muckart¹³ mentions that the fact that both air and blood are present in the pleural cavity may reflect the severity of the assault.

It is therefore not possible to compare the results of this study with the results of the study of Knottenbelt *et al*¹⁰ as it seems

that patients in this study were slightly more traumatised.

The attendance at the outpatient department at Hillbrow Hospital is poor, owing to socio-economic factors. If patients remain asymptomatic following discharge, they return to their previous occupation as soon as possible. Time lost in attending hospital leads to loss of earnings and a possibility of redundancy. Only thirty eight percent of patients who participated in the study attended outpatient follow-up clinics, and those who did attend, required no further treatment.

Conclusions as to whether this protocol (the commencement of chest physiotherapy immediately after insertion of the intercostal drain) can be equally applied in the case of gunshot wounds to the chest, would be premature, as these injuries are generally more lethal and are associated with more extensive destruction of tissue.

CONCLUSION

Although the number of patients surveyed in this study were small, the parameters used to assess the role of physiotherapy suggest a beneficial result when physiotherapy is instituted immediately after insertion of the intercostal drain.

The benefits are:

- a shorter duration of intercostal drainage and hospitalisation in these patients,
- lower prevalence of spiking temperatures in these patients,
- earlier discharge from hospital and a resultant earlier return to work, and
- saving on basic hospital costs.

It would therefore seem necessary for the ideal management of a patient with a stabbed chest that the surgical team should be supplemented with the presence of a physiotherapist in order to treat these patients immediately after insertion of the intercostal drain.

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Botswana is an independent, modern African country with stable economic prospects offering significant tax benefits to expatriates and the opportunity to remit salary worldwide. Gaborone, the capital, offers an attractive and sociable outdoor lifestyle with good private schooling facilities of a high standard.

Physiotherapist

A vacancy exists for the position of Physiotherapist at Gaborone Private Hospital.

The Hospital is part of Afrox group, one of the largest hospital management companies in the Southern African region.

We require the services of a Physiotherapist to join our complement. Duties will mostly entail hospital based physiotherapy with attention to ICU, Orthopaedics and other patients.

Applicants should be fully registered with a professional medical institution.

Non-citizens will be offered:

- 2 year contract with an attractive salary and a 25% tax free terminal gratuity.
- Non contributory medical aid scheme.
- Professional indemnity insurance

A competitive salary will be offered to the right candidate.

Applications with full Curriculum Vitae and a copy of registration certificate should be sent to:

The Personnel Resource Manager
Gaborone Private Hospital
Private Bag BR 130
Gaborone

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