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What is the yield of routine chest radiography following tube thoracostomy for trauma?

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ABSTRACT

Introduction: Routine chest radiography (CXR) following tube thoracostomy (TT) is a standard practice in most trauma centres worldwide. Evidence supporting this routine practice is lacking and the actual yield is unknown.

Materials and methods: We performed a retrospective review of 1042 patients over a 4-year period who had a routine post-insertion CXR performed in accordance with current ATLS® recommendations.

Results: A total 1042 TTs were performed on 1004 patients. Ninety-one per cent of patients (913/1004) were males, and the median age for all patients was 24 years. Seventy-five per cent of all injuries (756/1004) were from penetrating trauma, and the remaining 25% (248/1004) were from blunt. The initial pathologies requiring TT were: haemopneumothorax: 34% (339/1042), haemothroax: 31% (314/1042), simple pneumothorax: 25% (256/1042), tension pneumothorax: 8% (77/1042) and open pneumothorax: 5% (54/1042). One hundred and three patients had TTs performed on clinical grounds alone without a pre-insertion CXR [Group A]. One hundred and ninety-one patients had a pre-insertion CXR but had persistent clinical concerns following insertion [Group B]. Seven hundred and ten patients had pre-insertion CXR but no clinical concerns following insertion [Group C]. Overall, 15% (152/1004) [9 from Group A, 111 from Group B and 32 from Group C] of all patients had their clinical management influenced as a direct result of the post-insertion CXR.

Conclusions: Despite the widely accepted practice of routine CXR following tube thoracostomy, the yield is relatively low. In many cases, good clinical examination post tube insertion will provide warnings as to whether problems are likely to result. However, in the more rural setting, and in resource challenged environments, there is a relatively high yield from the CXR, which alters management. Further prospective studies are needed to establish or refute the role of the existing ATLS® guidelines in these specific environments.

Introduction

Tube thoracostomy (TT) is a commonly performed procedure in the management of thoracic trauma. The Advanced Trauma Life Support (ATLS®) course dedicates an entire session to teaching the indications and the safe technique of this procedure [1]. It is generally recommended that a chest radiograph (CXR) be performed following TT to confirm its position [1,2]. This recommendation lacks evidence and there is a paucity of literature on the value of routine CXR following TT in the trauma setting [3,4]. Our trauma service attempts to follow ATLS® recommendations in the management of trauma patients and we obtain post-insertion CXRs as a routine. The objective of this study was to review the yield of routine post-insertion CXR and its role in influencing clinical management in a high volume trauma service in South Africa.

Materials and methods

This was a retrospective study undertaken at the Pietermaritzburg Metropolitan Trauma Service (PMTS), Pietermaritzburg, South Africa. A retrospective review of our prospectively maintained regional trauma registry was conducted over a 4-year period from January 2010 to December 2013. Ethics approval for this study and to maintain this registry was granted by the Biomedical Research Ethics Committee (BREC) of the University of KwaZulu Natal (UKZN)

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(reference number: BE 207/09). The PMTS is a high volume trauma service that provides definitive trauma care to the western part of KwaZulu Natal province and covers a catchment population of over three million people. The annual trauma volume is approximately three thousand admissions with over 40% being due to penetrating trauma [5].

All patients who presented to the PMTS with thoracic trauma requiring placement of a TT, in our emergency room and who subsequently had a post-insertion CXR were included in this study. Only those patients with a complete data set and available CXRs on the data system were included. TT is performed by blunt dissection under local anaesthesia in the fifth intercostal space. Our experience suggests that successful placement into the pleural cavity is confirmed by the patient's clinical improvement, with the tube draining and or swinging. Our unit policy however (in line with the current ATLS® recommendations), is to perform a routine post-insertion CXR on every patient.

Basic demographic data collected include: age, gender and mechanism of injury. Further data on pre-insertion CXR, relevant radiological findings, and indications for TT were included. The patients were divided into three separate groups for analysis.

Group A: Patients in whom TT was performed on clinical grounds only without pre-insertion CXRs (e.g. tension pneumothorax following needle decompression, massive subcutaneous emphysema etc.).

Group B: Patients who had pre-insertion CXRs but had on-going clinical concerns following TT (e.g. drain not functioning, on-going symptoms etc.).

Group C: Patients who had pre-insertion CXRs, and who had no clinical concerns (e.g. drain draining and or swinging, clinical improvement) following TT.

All relevant data were extracted onto a Microsoft EXCEL© spread sheet for processing and analysis.

Results

Demographics

During the 4-year study period, 1004 patients had a total of 1042 TTs, 91% (913/1004) of patients were males and 9% (91/1004) were females, with a median age of 24 years. Seventy-five per cent (756/1004) of all patients sustained penetrating trauma, and the remaining 25% (248/1004) sustained blunt trauma. Of the 756 patients with penetrating trauma, 570 (75%) were from stab injuries, and 186 (25%) were gunshot injuries (GSWs). Of the 248 with blunt trauma, 136 (55%) were road traffic accidents (RTA), 96 (39%) were assaults, and 15 (6%) were falls. Table 1 summarises the mechanism of injury sustained in all 1004 patients.

Indications for TT

Of the 1042 TTs performed, 61% (634/1042) were inserted on the left side, and the remaining 39% (408/1042) were on the right. The initial pathologies requiring TT were: haemopneumothorax (HPTX): 33% (339/1042) haemothroax (HTX): 30% (314/1042), simple pneumothorax (SPTX): 25% (256/1042), tension pneumothorax (TPTX): 8% (79/1042) and open pneumothorax (OPTX): 5% (54/1042). Table 2 summarises the indications for TTs.

Table 1
Mechanism of injury.

Penetrating	*N* = 756	%
Stab	570	75
GSW	186	25
Blunt	*N* = 248	%
RTA	136	55
Assault	97	39
Fall	15	6

Table 2
Indications for TTs.

Indications	*N* = 1042	%
Haemopneumothorax	339	33
Haemothorax	314	30
Simple pneumothorax	256	25
Tension pneumothorax	79	8
Open pneumothorax	54	5

Subgroup

Of the 1004 patients who required TT, 90% (901/1004) had a pre-insertion CXR performed, while the remaining 10% (103/1004) of patients did not, as the TTs were performed purely on clinical grounds [Group A]. Nineteen per cent (191/1004) of all 1004 patients had persistent clinical concerns following TT [Group B]. Seventy one per cent of all 1004 patients had TTs and had no clinical concerns following insertion [Group C]. Post-insertion CXRs were performed in patients from all three groups. Overall, 15% (152/1004) [9 from Group A, 111 from Group B and 32 from Group C] of all patients had their clinical management influenced as a direct result of a post-insertion CXR. Table 3 summarises the proportion of patients from each group in whom post-insertion CXR did influence management.

Group A

There were a total of 103 patients in Group A, all of whom had TTs without pre-insertion CXR. Seventy-seven per cent (79/103) of these 103 patients had a tension pneumothorax and had undergone needle decompression prior to TT. The remaining 33% (24/103) were thought to have a simple pneumothorax on clinical grounds and had TT without a pre-insertion CXR. Of the 103 patients in Group A, 9% (9/103) had their clinical management influenced as a direct result of the post-insertion CXRs. The findings on the post-insertion CXRs that influenced management were five patients had a kinked tube which required readjustment, and four had tubes that were not inserted far enough and required reinsertion. Table 4 shows the post-insertion CXR findings that influence management in Group A.

Group B

There were a total of 191 patients in Group B, all of whom had a pre-insertion CXR performed as well as a post-insertion CXR. All 191 patients had persistent clinical concerns following TT. These concerns included 42% (80/191) who had TT inserted outside the safety triangle (discovered only after the tube was inserted and secured), 39% (75/191) who had a tube that was not draining or swinging, 10% (19/191) who remained clinically symptomatic despite TT, 7% (14/191) who had a tube that dislodged prior to the post-insertion CXR, 1% (2/191) who had blood draining following insertion for a simple pneumothorax, and 1% (1/191) who had gastric content in the tube. Of the 191 patients in this group, 58%

Table 3
Proportion in whom post-insertion CXR did influence management.

Group	*N* = 1004	Management influenced	%
Group A	103	9	9
Group B	191	111	58
Group C	710	32	5