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Results of Mandatory Exploration for Penetrating Neck Trauma

Justus P. Apffelstaedt, M.D., M.Med., F.C.S.(S.A.), Richard Müller, M.B.Ch.B., M.Med., F.C.S.(S.A.)

Department of Surgery, University of Stellenbosch, PO Box 19063, Tygerberg 7505, South Africa

Abstract. Management of penetrating wounds to the neck remains controversial despite decades of discussion in the literature. We assessed 393 consecutive stab wounds penetrating the platysma operated at our trauma service between January 14, 1991 and September 30, 1992 to evaluate our policy of mandatory neck exploration (NE). Injury to the common (n = 19 cases), external (n = 7), internal carotid (n = 5), innominate (n = 2), subclavian (n = 20), vertebral (n = 12), facial (n = 2), and intercostal (n = 2) arteries; the external (n = 36), internal (n = 65), subclavian (n = 20), and innominate (n = 4) veins; the pharynx/esophagus (n = 21); and the trachea (n = 28) was considered a positive NE (n = 167). 226 NEs were negative. Except for hemiparesis and bruit, the presence of clinical signs (shock, active hemorrhage, hematoma, surgical emphysema, dysphagia, blowing wound) did not predict a positive NE. Clinical signs were absent in 30% of positive NEs and in 58% of negative NEs. Complications of positive NE included wound infection (n = 7 cases), chyle drainage (n = 6), cerebellar stroke (n = 1), pneumonitis (n = 8), reoperation for recurrent hemorrhage (n = 1), subclavian artery graft occlusion (n = 1), bronchopleural fistula (n = 1), and cerebrospinal fluid leak (n = 1). Negative NEs were complicated by a wound infection in four cases and pneumonitis in one case. The mean hospital stay was 4.3 days for those with a positive NE and 1.5 days for those with a negative NE. Clinical signs are of no help in determining whether a stab wound to the neck has led to potentially life-threatening injury. Mandatory NE saves unnecessary invasive diagnostic studies, is associated with negligible morbidity, and incurs only a short hospital stay.

The management of penetrating wounds to the neck remains controversial despite decades of discussion in the literature. Proponents of a conservative approach charge that mandatory neck exploration (NE) results in a large number of unnecessary operations. Advocates of a policy of mandatory NE believe that neither clinical examination and frequent observation nor extensive invasive studies exclude potentially life-threatening injury, and that delayed NE is associated with prohibitive morbidity and mortality.

Methods

From January 14, 1991 to September 30, 1992 a total of 393 patients underwent NE exploration for stab wounds penetrating the platysma. In a prospective evaluation, the following data were recorded: clinical signs at presentation, operative findings, associated injuries, complications, and hospital stay. For purposes of this study an NE was defined as positive when injury to the following structures was found:

1. Arteries: internal, external, or common carotid; subclavian; innominate; facial, intercostal; internal mammary
2. Veins: external or internal jugular; subclavian; innominate
3. Pharynx/esophagus
4. Larynx/trachea

Results

The average age was 29.6 years (range 15–71 years). Clinical signs were absent in 30% of positive NEs versus 58% of negative NEs. A detailed breakdown of the clinical findings is shown in Table 1. The location of the stab wounds was zone I 17%, with positive NE in one-half of the cases; zone II 50%, with one-third of NEs positive; and zone III 33% with two-thirds of NEs positive.

Large-bore intravenous access lines were established in all patients; if necessary, central venous pressure (CVP) and Swan-Ganz lines were also employed. Resuscitation fluids were crystalloids and packed red blood cells as indicated. All patients received antibiotic prophylaxis with a second generation cephalosporin.

After clinical examination all patients had a chest roentgenogram recorded. Hemothorax or pneumothorax was present in 20% of positive NEs versus 14% of negative NEs. Sudden airway obstruction necessitated emergency tracheostomy in five patients and intubation in two patients while awaiting exploration. Three of these patients had had no clinical signs at presentation. The patients were then taken to the operating room and a formal NE performed. Access was via an anterior sternomastoid incision in 62%, a supraclavicular incision in 17%, sternotomy in 3%, local incision in 9%, and combinations of the above in 9% of cases. The findings at NE are shown in Table 2.

The common and internal carotid, innominate, and subclavian artery injuries were repaired after débridement by direct suture in 20 cases; in 26 cases loss of length necessitated interposition of a PTFE prosthesis. Other arteries were uniformly tied off. Venous injuries were treated by ligature or repair. Aerodigestive tract injuries were repaired by suture. Routine tracheostomy was not used. After esophageal repair, the patients were fed by nasogastric tube for 5 days, after which the integrity of the repair was checked by contrast radiography. Injuries to the brachial plexus or cranial nerves (23 cases) were repaired by direct suture, or the transected ends were marked to facilitate repair when instant repair was not

Correspondence to: J.P. Apffelstaedt, M.D.

Table 1. Signs found at clinical examination.

Sign	Positive NE (%)	Negative NE (%)
Shock	24.0	7.0
Active bleed	40.0	19.0
Hematoma	26.0	22.0
Surgical emphysema	6.6	1.3
Hemiparesis	2.4	0
Dysphagia	4.2	3.1
Blowing wound	4.2	1.8
Bruit	3.6	0
None	30.0	58.0

possible. Operating theater time averaged 83 minutes for those with positive NEs and 44 minutes for patients with negative NEs.

The postoperative course after a positive NE was complicated by wound infection in seven cases. All of these patients responded to conservative measures. One infected hemothorax required rib resection. Pneumonitis was diagnosed in eight patients, all of whom responded to antibiotics and chest physiotherapy. One overlooked mediastinal venous injury necessitated reoperation for hemostasis. Four cases of chyle drainage resolved spontaneously, two resolving after a course of medium-chain triglyceride diet. One subclavian artery graft occluded; reexploration will be carried out only if repair of the completely transected brachial plexus, carried out at the same session, proves successful. One case of cerebellar stroke, confirmed by cranial computed tomography (CT), after the vertebral artery was tied off improved such that the patient could be discharged home after 9 days with complete resolution of symptoms. Another patient suffered a transient neurologic deficit after the innominate artery had been repaired. A cranial CT scan of this patient did not reveal signs of infarction. Of four patients with preoperative hemiparesis, only two improved postoperatively. The carotid arteries were repaired in all cases. One bronchopleural fistula and one cerebrospinal fluid leak responded to conservative measures. Positive NE was thus complicated in 16%. There were no deaths. Negative NE was complicated by wound infection in four cases and pneumonitis in one case, for a complication rate of 2.2%; all cases responded to conservative therapy. No deaths occurred.

Hospitalization was on average 4.3 days for 167 patients with positive NEs; for 182 patients with a negative NE it was 1.5 days. Negative NE associated with hemothorax or pneumothorax increased the hospitalization to 4.5 days in 32 cases. With concomitant thoracotomy or laparotomy for associated injury, hospitalization was 4.6 days in 12 cases.

Discussion

There is no dispute among surgeons about the need to operate on patients with clinically obvious injuries to vital structures in the neck. Disagreement on management arises only in the absence of clinical signs. Whatever the prevailing philosophy at the institution, the aim is to prevent unnecessary morbidity and mortality and to reduce hospital cost without increasing the risk to the patient.

Numerous reports suggest that for the management of penetrating trauma to the neck mandatory exploration [1–3] or a selective approach based on clinical and radiologic findings can be followed with equally good results [4–13]. None of these reports,

Table 2. Findings at NE: organs injured.

Organ injured	No.	No. clinically silent
Arteries		
Common carotid	19	2
Internal carotid	5	0
External carotid	7	1
Innominate	2	0
Subclavian	20	4
Vertebral	12	3
Facial	2	0
Intercostal	2	0
Veins		
Internal jugular	65	15
External jugular	36	8
Subclavian	20	6
Innominate	4	0
Pharynx/esophagus	21	4
Larynx/trachea	28	10

however, discloses information on the length of the interval between injury and triage at the hospital; in the present study 95% of patients were assessed within 1 hour of injury and operated on within 3 hours of the injury. Such a short time interval may preclude the development of clinical signs, a hypothesis borne out by the seven patients who required emergency airway control while awaiting operation. Their cases also demonstrate that a selective approach based on clinical signs should be followed only in institutions where intensive observation of patients is possible.

Should, then, all patients without clinical signs be subjected to invasive radiologic studies? A blanket approach, including panendoscopy, contrast studies of the esophagus, and arteriography, for every patient is not only more expensive than negative NE [6], it ties up personnel and equipment for at least the same duration as a negative NE. Furthermore, false-negative and false-positive results occur in significant numbers, especially for contrast and endoscopic studies [3, 6, 8, 14]. Some authors also contend that angiography does not alter the course of management in asymptomatic patients [15].

There is no consensus regarding the clinical signs that indicate the need for operation. Our results indicate that even suggestive signs, such as shock on admission and active hemorrhage, may be associated with negative findings at NE.

Our results confirm that a negative NE is associated with a negligible complication rate and a short hospital stay. In the series reported in the literature, patients on selective management were observed for 1.8 to 5.6 days [5–8, 10–12, 16]. The workload imposed on the medical staff by a regimen of intensive observation for 3 days may be greater than the average 44 minutes it takes to perform a negative NE, including the recovery room stay. It certainly reduces the demand for hospital beds. In the meantime, we have started to discharge patients after negative exploration from the recovery room, further reducing the hospitalization time to 0.8 days for negative NEs without associated other injuries.

In conclusion, we suggest that in a hospital such as ours, where a specialized trauma service and expertise in the management of these injuries are readily available, the most efficient way to deal with a high incidence of penetrating neck trauma is mandatory exploration.

Résumé

Le traitement de plaies pénétrantes du cou reste controversé malgré des décennies de discussion dans la littérature. Nous avons évalué les résultats de notre politique d'exploration systématique (ES) dans 393 plaics du cou ayant franchi le muscle peaucier traités dans notre unité de soins entre le 14 Janvier 1991 et le 30 Septembre 1992. Ont été considérée comme une ES «positive» (n = 167) les plaies des artères carotide commune (n = 19), externe (n = 7), interne (n = 5), sous-clavière (n = 20), vertébrale (n = 12), faciale (n = 2) et intercostales (n = 2), du tronc brachio-céphalique (n = 2), des plaies des veines jugulaire interne (n = 65), externe (n = 36), sous-elavière (n = 20) et innominée (n = 4), des plaies du pharynx/oesophage (n = 21) et de la trachée (n = 28). Deux cent vingt six ES ont été considéré comme «négatives». Exceptés l'hémiparésie et le souffle carotidien, la présence de signes cliniques (choc, hémorragie active, hématome, emphysème, dysphagie, une plaie soufflante) n'était pas prédictive d'une ES positive. Ces signes étaient absents dans 30% des ES positives et présents dans 42% des ES négatives. Les complications de l'ES positive ont été une infection de la plaie (n = 7), une lymphorrhée (n = 6), un accident vasculaire cérébral (n = 1), une infection pulmonaire (n = 8), une réopération pour hémorragie récidivante (n = 1), une occlusion de greffe de la sous-clavière (n = 1), une fistule bronchopleurale (n = 1), et une fuite de liquide céphalo-rachidien (n = 1). L'ES négative a été compliquée d'infection (n = 4) et d'une infection pulmonaire (n = 1). La durée moyenne de séjour hospitalier a été de 4.3 jours en cas d'ES positive, et de 1.5 jours pour une ES négative. En conclusion, lors d'une plaie pénétrante du cou, les signes cliniques ne permettent pas de déterminer s'il y a des lésions potentiellement létales. Une ES est associée avec une économie d'investigations souvent inutiles, une morbidité réduite et une durée d'hospitalisation plus courte.

Resumen

Luego de decenios de discusión, persite la controversia sobre el manejo de las heridas penetrantes del cuello. Hemos analizado 393 heridas cortopunzantes penetrantes del músculo platisma o cutáneo del cuello operadas en nuestro servicio de trauma entre enero 14 de 1991 y septiembre 30 de 1992, con el fin de valorar nuestra política de exploración cervical obligatoria (EC). Se consideró como EC positiva (167 casos) cuando la herida afectaba las arterias carótida primitiva (19 casos), externa (7), interna (5), innominada (2), subclavia (20), vertebral (12), facial (2) e intercostales (2), las venas yugular externa (36), interna (65), subclavia (20) e inominada (4), la faringe/esófago (21) y la tráquea (28); 226 ECs fueron negativas. Excepto por hemiparesia y soplos, la presencia de signos clínicos (shock, hemorragia activa, hematoma, enfisema quirúrgico, disfagia, herida sopladora) no constituyó un factor positivo de predicción de la EC. Los signos clínicos estuvieron ausentes en 30% de las ECs positivas y en 58% de las negativas. Las complicaciones de las ECs positivas incluyeron infección de la herida (7 casos), drenaje quiloso (6), accidente cerebelar (1), neumonitis (8), reoperación por hemorragia recurrente (1), oclusión de un injerto arterial subclavio (1) fistula brocopleural (1) y fistula de líquido cefalorraquídeo (1). Las ECs negativas se complicaron por infección de la herida en 4 casos y neumonitis en 1 caso. El promedio de la estancia hospitalaria fue de 4.3 días para las ECs positivas y de 1.5 días para las ECs negativas. Los signos clínicos no son de ayuda en cuanto a establecer si una herida corto- punzante del cuello ha dado lugar a una lesión potencialmente letal. La exploración cervical obligatoria ahorra estudios diagnósticos invasivos innecesarios e implica una morbilidad insignificante y una corta estancia hospitalaria.

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