**ABSTRACT**

**Background:** Neck penetrating injuries are a life-threatening emergency. To date, one of the areas of ongoing controversy is whether all penetrating neck wounds in Zone II still require surgical exploration or whether patients can be managed non-operatively. An approach with absolute exploratory management for every penetrating neck wound results in a substantially reduced mortality rate.

**Case Description:** We presented 5 cases of neck penetrating injury patients. In the first case, a 33-year-old man presented with a neck wound, hoarseness and subcuticular emphysema; the patient underwent colli exploration. In the second case, a 39-year-old man presented with multiple wounds in the neck, hematemesis and subcuticular emphysema; the patient underwent colli exploration. In the third case, a 27-year-old male patient presented with an 8 cm long open wound on the anterior colli, a visible rupture of cricoid and thyroid cartilage; the patient underwent tracheostomy and debridement. In a fourth case, a 37-year-old male patient presented with a 12 cm long sutured wound in the anterior colli, hoarseness, emphysema and air bubbling from the wound; the patient underwent colli exploration. In the fifth case, a 41-year-old male patient presented with a 7 cm long sutured wound at the anterior colli and a defect on thyroid cartilage; the patient underwent colli exploratory surgery.

**Conclusion:** A hard sign was obtained in all five cases, and immediate colli exploration was performed without diagnostic supportive examination. The decision to perform surgery is now based on the presence or absence of “hard signs” of a penetrating neck wound.

**Keywords:** penetrating neck injury, surgical exploration, zone II, immediate colli exploration.

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**INTRODUCTION**

A penetrating neck wound is a life-threatening emergency caused by gunshot wounds, stab wounds, or broken objects such as glass or bullet projectiles that penetrate the platysma muscle. Penetrating neck wounds can cause injury to the aerodigestive and neurovascular systems. Penetrating neck wounds are considered a difficult trauma to manage given the complex anatomical structure of the neck, composed of vital organs, and therefore can cause airway and hemodynamic disturbances.

Surgery has become routine in all patients with penetrating neck injuries to reduce the high mortality rate, regardless of the signs and symptoms or the patient’s clinical condition or site of injury. The approach of absolute exploratory management for every penetrating neck wound led to a substantial reduction in mortality rates. The development of technology in medicine, especially in the field of diagnostic and minimally invasive measures, is one of the factors influencing changes in the management of penetrating neck wounds. Until now, one of the ongoing controversies remains whether all penetrating neck wounds in zone II still require surgical exploration or whether patients can be managed non-operatively.

In this descriptive case series study, the authors will describe the profile of patients with penetrating neck trauma in the Head and Neck Surgery division of Dr. Soetomo Hospital related to the mechanism of trauma, clinical, and surgery as many as 5 cases of patients with penetrating neck trauma in the 2019-2022 period.

**CASE DESCRIPTION**

**Case 1**
On October 25th, 2019, a 33-year-old man with a history of schizophrenia presented to the emergency room after he stabbed himself in the neck with a knife. The patient presented with stable hemodynamics, and physical examination revealed a sutured wound, hoarseness and subcuticular emphysema from the right submandibular region to the right supravacular region. There was no active bleeding, hematoma or shortness of breath. However, there was air bubbling from the wound. A cervical photograph was taken, and subcuticular emphysema was found. The patient underwent colli exploration on October 25th; ruptured tracheal rings 1 and 2 with a length of 2 cm were found, and primary rupture reparation and tracheostomy were performed (Figure 1).
**Case 2**

On May 28th, 2021, a 39-year-old man with a history of delusions came to the hospital after stabbing himself in the neck with a 15 cm knife. The incident was known to the family living in the same house; the patient vomited about 100 ml of blood, and there were blood clots. The psychiatric department treated the patient and referred him to the surgical department. The patient presented with stable hemodynamics and was fully conscious. Physical examination revealed multiple sutures wounds, hematemesis and left right submandibular to left right...
supraclavicular subcuticular emphysema. A schematic figure of the injury is shown in Figure 2. There was no active bleeding, hematoma or shortness of breath.

The patient performed colli exploration on May 28th, 2021. During the operation, the right vulnus icturn regio colli zone II, penetrating the m.stylohyoid, laryngopharyngeal rupture Ø 3 cm, left vulnus icturn regio colli zone II penetrated the oropharynx Ø 1 cm (Figure 3). Tracheostomy, repair of laryngopharynx D and S oropharynx.

Case 3
On May 26th, 2021, A 27-year-old male patient came to the hospital after slitting his throat with a knife because he heard whispers; the incident occurred by the river near the boarding school. The patient has a history of using methamphetamine drugs for 9 years. Then, the patient entered the boarding school and stopped using drugs. The patient came with stable hemodynamic conditions and was fully conscious. The physical examination revealed an 8 cm long open wound on the anterior colli, visible rupture of the cricoid cartilage and thyroid cartilage, pus and slough Trachea in the center, tracheal ring intact. There was no active bleeding or shortness of breath.

The patient underwent tracheostomy and debridement on the fourteenth day of hospitalization (Figure 5). A total rupture of the cricothyroideal membrane separating the cricoid cartilage and thyroid cartilage was found, with intact epiglottis, esophagus, and trachea (Figure 6). Primary suturing of cricoid cartilage and thyroid cartilage was performed.

Case 4
On September 28th, 2021, A 37-year-old male patient came to Dr. Soetomo general hospital, Surabaya. The patient stabbed himself twice in the neck with a kitchen knife after getting a whisper from a male voice to stab his neck (auditory hallucination). After the incident, the patient complained of bleeding from the stab wounds. There was no complaint of shortness of breath. The patient was immediately taken to the emergency room of Mawardi Krian Hospital, and situational suturing was performed and then referred to Dr. Soetomo general hospital, Surabaya. The patient came with a stable hemodynamic condition and was fully conscious. The physical examination showed a 12 cm long sutured wound in the anterior colli, hoarseness, emphysema and air bubbling from the wound. There was no active bleeding or shortness of breath.

The patient underwent colli exploration and a rupture of m. Sternohyoid, m. omohyoid, thyroid cartilage, and anterior larynx with a +/- 1 cm defect was found (Figure 7). Performed primary repair of the larynx, primary repair of thyroid cartilage, and repair of the sternohyoid and omohyoid.

Case 5
On June 26th, 2021, a 41-year-old male patient came to the hospital. His family found the patient with neck, left hand, and left leg wounds. On the left foot, when the patient was alone in the house, the patient used a kitchen knife to slice the neck, hands and feet. The patient hallucinated hearing whispers to hurt himself. The patient was taken to William Booth Hospital Surabaya, sutured the wound and then referred to Dr. Soetomo general hospital, Surabaya. The patient came with a stable hemodynamic condition and was fully conscious. The physical examination showed a 7 cm long sutured wound at the anterior colli, no additional breath sounds, a defect of thyroid cartilage rupture measuring 2cm, and no active bleeding. There were also open wounds on the left wrist and left ankle, but no active bleeding.

The patient underwent colli exploratory surgery, which found a Total rupture of thyroid cartilage above the plica vocalis and a rupture of the right and left thyrohyoid. Performed tracheostomy, primary repair of thyroid cartilage, and thyrohyoid muscle repair.

DISCUSSION
The most common causes of penetrating neck wounds presenting to emergency departments are gunshot wounds and cuts, but other causes, such as hunting accidents, can also cause them. Neck injuries from traffic accidents are usually blunt injuries. Demographics also influence these causes. One Canadian study reported the leading cause to be stab or cut wounds (95% of 130 cases).1 Penetrating wounds from gunshots are more likely to cause injury to vital neck structures than wounds from stab or cut wounds. The wounds from each cause have different characteristics that influence the course of action.2 A review by Bagheri et al. mentioned that most of the 120 patients with penetrating neck wounds were from attacks with lethal weapons; however, 36 patients had injuries from accidents and 28 from self-inflicted injuries.3 Attacks with lethal weapons consisted of 31 patients with gunshot wounds, 63 with stab injuries, 13 with injuries from broken glass, and 13 with sharp objects. Of the 120 patients, 55 had superficial injuries that did
not penetrate the platysma. These patients were generally adequately managed in the ED with wound debridement and primary closure. The main study group of this review consisted of 65 patients with more significant injuries that penetrated the platysma, deep, complex, or avulsive wounds, vascular injuries, or injuries to the aerodigestive tract, musculoskeletal system, nerves, cranial, or thyroid gland. Of these, 13 patients had zone I injuries (16%), 50 patients had zone II injuries (64%), and 16 patients had zone III injuries (20%).

This zonal division has implications for the management and prognosis of penetrating wounds in the neck. Wounds in zone I may involve the mediastinum, where vascular control is difficult. Similarly, vascular injuries in zone III, especially those more cephalad, can pose significant surgical challenges. Penetrating wounds may extend beyond the zone boundaries depending on the mechanism of injury, such that external injuries in Zone internal injuries in Zone II or the mediastinum may accompany me.

In cases 1, 3, 4, and 5, the stab wounds were in the anterior part of the colli, so the injuries were obtained in the middle structure, here the aero system, both trachea, thyroid cartilage and cricoid. In case 2, a penetrating wound was obtained in the anterior part of the colli and the right and left lateral parts so that the injuries obtained were ruptures of the sinistra oropharynx and dextra laryngopharynx.

In the 5 patient cases we presented in this case series, all were immediately operated on without further diagnostics by angiography / CT angiography, CT scans, or endoscopy/barium studies. In cases 1, 2 and 4, air bubbling was found in the penetrating wound, and in cases 3 and 5, rupture of the airway was seen from the penetrating wound. So, all five have hard signs for the aerodigestive system, even though hemodynamics are stable. Therefore, based on the algorithm for the no-zonal management of penetrating neck injuries, the five cases were immediately subjected to surgical exploration, with no need for additional supporting examinations. Of the 5 cases, 4 cases have performed a tracheotomy, where 1 case was found to have a tracheal rupture, 1 case had a rupture of the laryngopharynx dextra and oropharynx sinistra, and 2 cases had a total rupture of thyroid cartilage. In contrast, 1 case with partial rupture of the thyroid cartilage and larynx was not performed tracheotomy.

Invasive airway management is the standard approach when orotracheal intubation by any method is unsuccessful or contraindicated. Immediate indications for airway surgery include massive upper airway distortion, massive trauma to the mid-face, and inability to visualize the glottis due to severe bleeding, edema, or anatomical disruption. Cricothyrotomy and tracheotomy are the most commonly used procedures for severe neck trauma. Cricothyrotomy is recommended as the initial surgical airway option, as it is the most direct, simple and safe way to bypass upper airway obstruction or injury. This may be difficult if there is anatomical distortion of the neck or if anterior neck hematoma or laryngeal injury is suspected and there is a potential risk to the vocal cords. Tracheotomy may be required if there is significant structural airway disruption, damage, and transection of part or all of the larynx or trachea. The tracheotomy incision should be as low in the neck as possible to avoid further injury to the laryngotracheal complex. The incision should be made vertically, allowing inferior extension to obtain better anatomical exposure.

The algorithmic approach to the non-zonal management of penetrating neck injuries is the same as other trauma patients with Advanced Trauma Life Support (ATLS) resuscitation. Patients who are unstable and exhibit any “hard signs” or visceral injury should have immediate surgical exploration. All stable patients should undergo multidetector helical computed tomography with angiography to evaluate visceral injury.

The non-zonal approach in evaluating and managing penetrating neck trauma is contemporary. It differs from the anatomical zone management algorithm used for the past 50 years. Several studies have shown that the non-zonal approach is superior to the traditional approach in managing penetrating neck trauma, especially in reducing negative neck exploration. The no-zonal algorithm approach suggests the use of MDCT-A for the evaluation and management of penetrating neck injuries. There are currently no international guidelines and a general lack of consensus in the literature regarding the optimal assessment and treatment of penetrating neck injuries. Further research is therefore needed to continue to improve our understanding of the management of penetrating neck trauma.

**CONCLUSION**

A hard sign was obtained in all five cases, and immediate colli exploration was performed without diagnostic, supportive examination. Nowadays, the “No Zone Approach” is more widely adopted, where the division of neck penetrating wound management based on the division of 3 anatomical zones is no longer relevant. The decision to perform surgery is now based on the presence or absence of “hard signs” of a penetrating neck wound.

**CONFLICTS OF INTEREST**

No competing interests were declared.

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**ETHICAL CLEARANCE**

Patient approval has obtained in this study and fulfilled ethics approval from International Committee of Medical Journal Editors (ICMJE).

**AUTHOR CONTRIBUTION**

All of the authors equally contributed to the study.

**REFERENCES**

3. Tallon JM, Ahmed JM, Sealy B. Airway management in penetrating neck trauma at a Canadian tertiary trauma centre.
CJEM. 2007;9(2):101–4. doi: 10.1017/s148180350001486x


