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Early total care in polytrauma patient with floating shoulder and occlusion of bilateral subclavian artery: A case report

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ABSTRACT

INTRODUCTION: Fracture in polytrauma patients have higher risk of morbidity and mortality compared to those found in monotrauma patients. The ideal approach of orthopaedic injuries is to perform definitive fixation of all fractures in one single procedure, an approach known as Early Total Care (ETC).

PRESENTATION OF CASE: A patient presented with history of being struck by heavy material forklift. He complained of pain in the shoulder and difficulty in breathing. The patient was diagnosed with polytrauma ISS Score 25, which consists of floating shoulder, closed fracture of multiple ribs, open hemothorax, and thrombosis of subclavian artery. The following procedures were performed: debridement, ORIF plate and screw of right clavicle, ORIF lag screw of right glenoid scapula, thoracotomy segmental lobectomy, bypass of bilateral carotid artery to bilateral brachial artery.

DISCUSSION: An early surgical treatment is paramount in the management of this patient, with the aim of restoring the joint and blood flow to the distal part of the hand, which will allow for early motion and more effective physiotherapy for the patient's recovery.

Early definitive fracture fixation in ETC is recommended in for stable patients and those who falls under the category of borderline and unstable patients who responds well to resuscitation. ETC allows for early mobilization and therapies for the patient.

CONCLUSION: Early total care is an appropriate choice of treatment for polytrauma patients presenting with floating shoulder.

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1. Introduction

Polytrauma is defined as a blunt force trauma with multiple injuries, involving multiple regions of the body with a compromise to the patient's physiology and a potential dysfunction of the uninvolved organs. One of the hallmarks of polytrauma cases are fractures, which may cause compartment syndrome with ischemia-reperfusion injury. Compared to monotrauma patients, polytrauma patients have higher risk of morbidity and mortality. An ideal approach to orthopaedic injuries for patients with polytrauma is to perform definitive fixation of all fractures in one single operation in the operating room; an approach called Early Total Care (ETC). ETC allows for an efficient employment of the orthopaedic surgeon and operating room staff. Additionally, it also permits for prompt mobilization to perform any tests and therapies for the patients [1].

Nowadays, there are numerous advancements in ETC technique of osteosynthesis and trauma resuscitation, which allows for a bet-

ter cardiorespiratory monitoring and ability to perform prolonged artificial ventilation. Among polytrauma patients treated with ETC, the majority have less pulmonary complications, reduced duration of intensive care unit (ICU) and a shorter hospital stay (LOS) compared to patients with delayed surgery [1].

There are multiple pathophysiological changes in polytrauma, including haemorrhagic shock and tissue damage. These changes, along with patient factors and secondary insults from surgical interventions, provide a proinflammatory state. Whenever the inflammatory response is exaggerated or dysfunctional, the patient may suffer from a systemic inflammatory response syndrome (SIRS) or even multiple organ failure (MOF). The benefit of performing ETC in fracture in patients with polytrauma is skeletal fracture stabilization, causing reduced pain, easier positioning of the patient in intensive care unit (ICU) and decreased blood loss [2].

We presented a case report of patient with floating shoulder and occlusion of bilateral subclavian artery in case of polytrauma. This report has been presented according to SCARE criteria [3].

2. Patient information

A polytrauma patient was referred to our hospital with history of being struck by heavy material forklift while he was repair-

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Fig. 1. Clinical Manifestation of the Patient upon Arrival. Oxygen mask was attached with the rate of 10 L/minute. There were open wound and skin tenting.

ing it. After the injury, the patient felt pain in the shoulder and experienced difficulty in breathing. Patient was directly brought to Tangerang General Hospital and got chest tube and water seal drainage (WSD). Patient then was referred to our hospital due to suspected massive hemorrhage from WSD.

3. Clinical findings

The patient's Glasgow Coma Scale (GCS) is within normal limits, he was wearing oxygen mask with the rate of 10 L per minute. The patient breathed spontaneously with respiratory rate of 44 times per minute. The blood pressure was 100/90 mmHg with the aid of 0,6 mcg/hour vasoconstrictor. On the thorax region, there were bruise and wound, with asymmetrical chest motion and decreased vesicular sound on the right side. There was ronchi heard on the right side of the thorax.

Examination of the left shoulder showed a deformity with skin tenting and subcutaneous-based open wound (Fig. 1). There was sucking wound on the right upper thorax, with an attached WSD producing blood with the rate of 30 cc/hours, undulation, and positive force expiratory bubble. There was tenderness with VAS of 3–4, normal distal sensory, and capillary refill time of less than 2 s. The movement of shoulder was limited due to pain. Other movements were within normal range.

4. Timeline

Time	Symptom and Signs	Treatment
2 days prior to admission	Pain on right shoulder and difficulty in breathing	Oxygen mask, WSD, pain management
5 h after admission	Pain on right shoulder and difficulty in breathing	Pain on right shoulder and difficulty in breathing

5. Diagnostic assessment

Laboratory examination showed slightly increased leukocyte count. Radiologic examination of the shoulder showed fracture of right clavicle, right scapula, and 1st, 2nd, 3rd, 4th, 5th and 6th rib bones (Fig. 2). The patient was diagnosed with polytrauma ISS Score 25 consisting of floating shoulder (closed segmental fracture of right clavicle Allman group 2 and closed fracture of right scapula ZD 3), closed fracture of right costae 1 st, 2nd, 3rd, 4th, 5th and 6th, hematopneumothorax, and thrombosis of the subclavian artery. Based on these clinical conditions, we classified this patient into borderline class (ISS 25) with a Hannover Score of 13 with PTS Classification Group I.

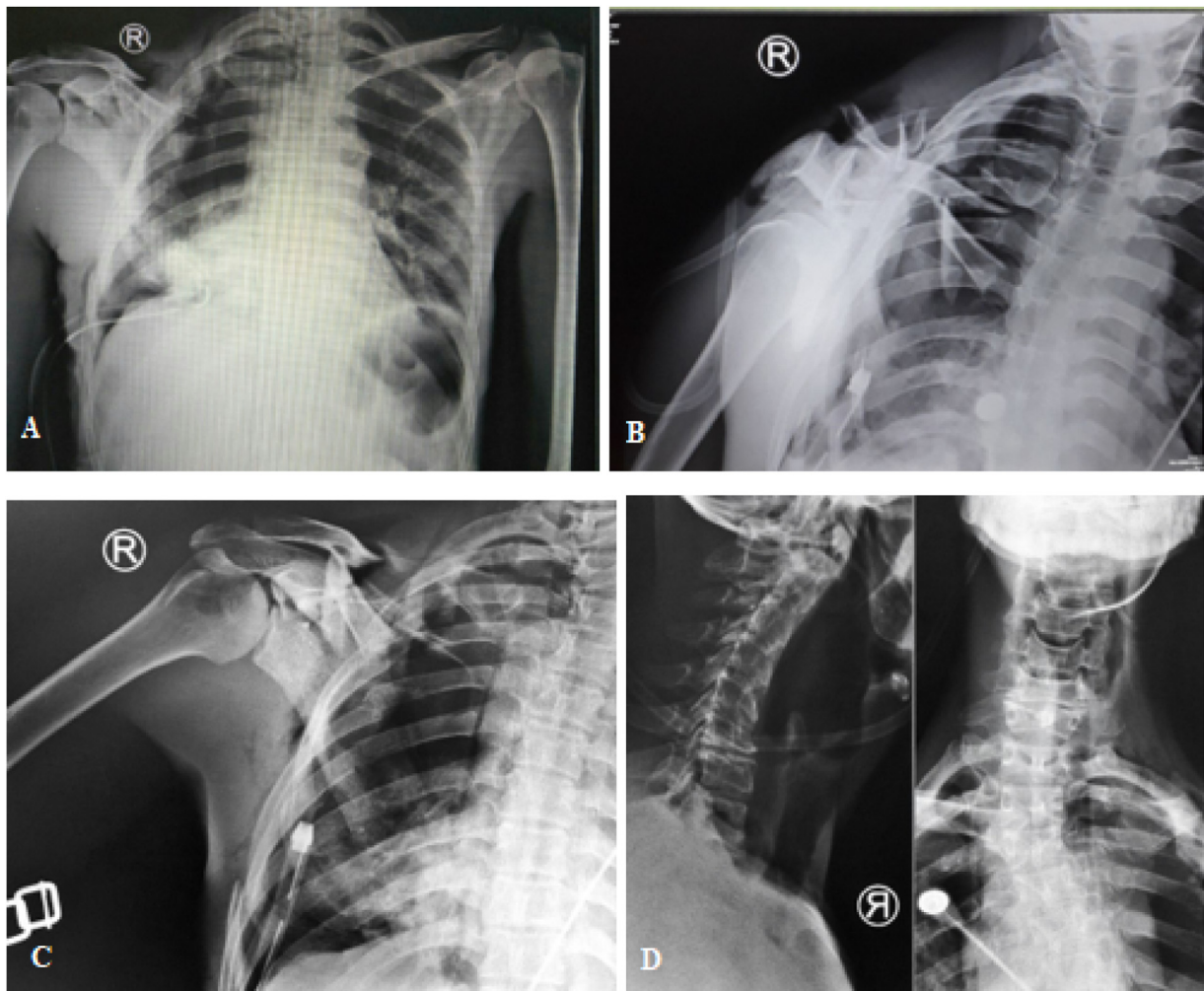


Fig. 2. Radiologic Examination of the Patient. (A) AP view and (B)(C) lateral view of the right shoulder X-Ray showed fracture of the clavicle and scapula. (D) Cervical x-ray showed normal findings.

6. Therapeutic intervention

The patient underwent thoracotomy segmental lobectomy, ORIF plate and screw of right clavicle and ORIF lag screw right glenoid scapula on the first surgery (Fig. 3). The surgery was conducted to apply lag screw on scapula and plate and screw on the clavicle. Second surgery was performed to remove the plate and screw as well as to apply bone graft of the clavicle and re-insertion of the plate and screw. Intraoperatively, bilateral occlusion of subclavian arteries was found and bypass was performed on the right carotid artery to right brachial artery (by thoracic and cardiovascular division).

7. Follow up and outcomes

Immediately after surgery, AP x-ray of the shoulder was acquired (showed in Fig. 4). The lag screw and the plate and screw appeared well seated to reduce the scapular and clavicular fracture respectively. One day after operation, pulsation of brachialis artery, radialis artery, and ulnaris artery was +1 with 100 % of oxygen saturation.

One year follow up shows that the patient showed some degree of improvement with a DASH score of 52.5. The patient is capable of doing daily activities such as preparing his own meal, carrying his own belongings, and dressing himself, with some degree of difficulties. Activities that require a higher degree of ROM such as washing one's back and putting things away in places higher than one's head

is still doable for the patient, albeit with difficulties. The patient's X-ray also showed no disturbances in the implants as showed in Fig. 5, as well as a good clinical outcome with an improvement in the patient's ROM as showed in Fig. 6.

8. Discussion

Patients with polytrauma are most likely to have musculoskeletal injuries that require surgical intervention, and the presence of such injuries are associated with worse clinical outcome, which in turn will affect the patient's functional outcome and quality of life [4]. This could be optimized by applying the principles of Early Total Care, of which the patient's condition is assessed based on the anatomic location and severity of injury and the management plan of the patient's condition is decided; whether it is decided to perform early, definitive surgery within the first 24 h or to perform rapid stabilization immediately and postpone the definitive surgery [1,4]. In this patient, this concept is applied in order to achieve the best possible functional outcome. This is the basis of why the surgeon decided to perform ORIF plate and screw on this patient's shoulder. Similar cases of polytrauma has already been discussed multiple times in the literature; a case report from India showed that in polytrauma patients with musculoskeletal injuries, early definitive osteosynthesis yields better clinical and functional outcome, as long as the patient is stable or otherwise responds well to resuscitation [5].

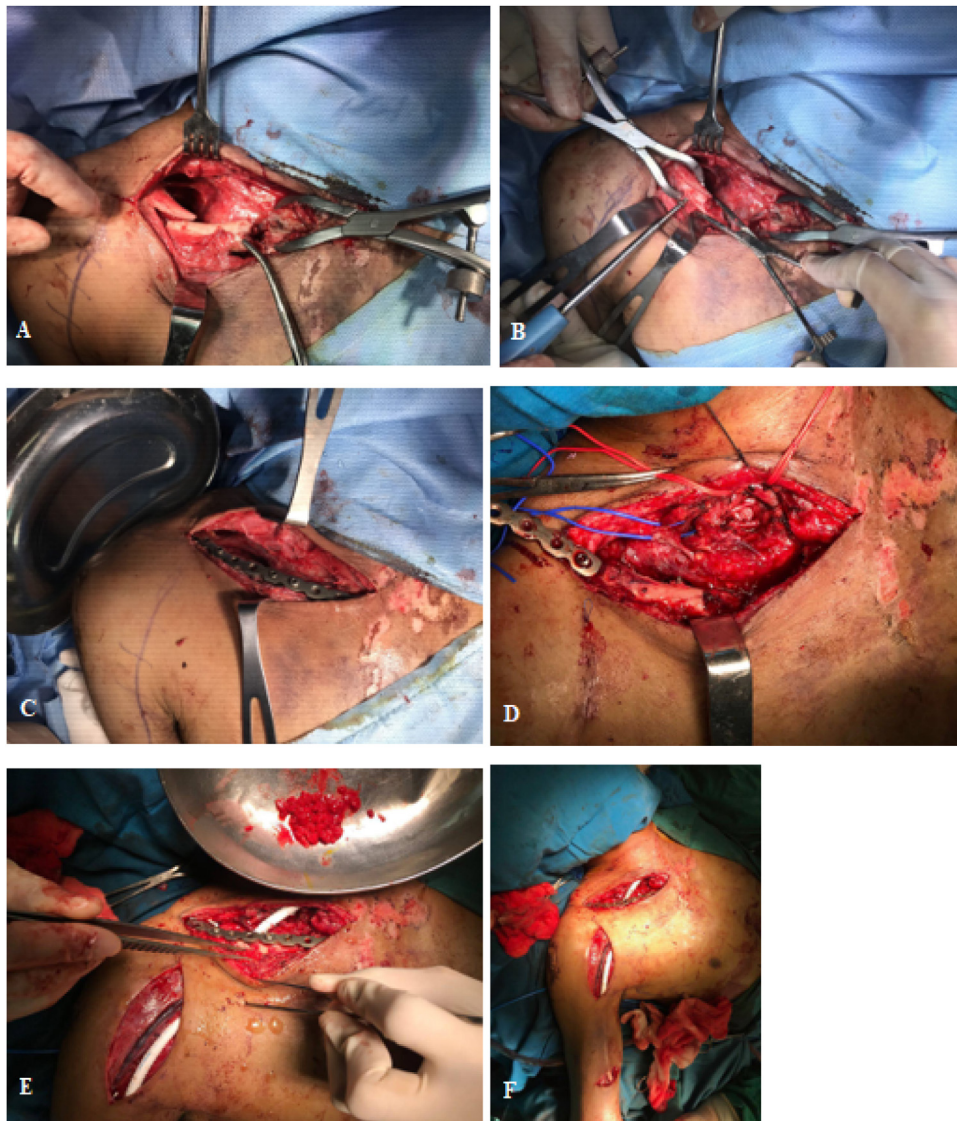


Fig. 3. Intraoperative Procedure. (A) Fracture of the scapula was exposed and (B) lag screw was applied. (C) Final construct of plate and screw for clavicle fracture in the first surgery. In the second surgery, (D) plate and screw was removed and (E) bone graft was applied to enhance osteogenesis, plate and screw was re-inserted, and arterial bypass was applied. (F) Final construct.

The main characteristic of floating shoulder is displaced fracture of the scapular neck with one the following: ruptures of the coracoacromial (CA) and coracoclavicular (CC) ligaments; disruption of the acromioclavicular (AC) joint; or fracture of the clavicle; disruption of the attachments of the distal fragment to the proximal fragment and the axial skeleton, including the glenoid is attributed to the pulling force of the surrounding muscles and the weight of the arm. Nonoperative treatment of the floating shoulder poses some risks; abduction movement of the shoulder may be weakened, range of motion reduced, as well as chronic pain, malunion, and non-union [6]. For that reason, we applied bone graft to improve the osteogenesis for this patient.

Floating shoulder represents a double disruption of the superior shoulder suspensory complex. In isolation, each fracture is generally minimally-displaced and can be managed non-operatively. In combination, however, both disruptions render the other unstable; for example, the glenoid neck fracture may increase the displacement of the clavicular fracture site and vice versa. Hardegger et al. and Butters recommended surgical in these cases; reduction and stabilization of the clavicular fracture by screw/plate fixation is advisable if the displacement is unacceptable. It reduces the risk of

nonunion, alleviates tension on the brachial plexus, restores normal anatomical relationships, and ensures the normalization of shoulder function. The fracture of the glenoid neck will self-reduce and stabilize following the procedure. However, if significant displacement persists, it should be reduced and fixed. Additional injuries of the clavicular-acromioclavicular joint-acromial strut may also require operative treatment, whereas associated injuries of the coracoacromial ligament and the C-4 linkage will usually heal adequately if the fracture sites of the glenoid neck and clavicle are treated appropriately. The order of fixation is debatable and remains at the discretion of the surgeon. Initial fixation of the clavicle may allow indirect reduction of the glenoid segment and negate the need for a posterior procedure. However, if significant displacement persists, the fracture of the glenoid must also be addressed.

Reversibly, fixation of the displaced glenoid segment may be deemed more important and can be carried out first, followed by open reduction and internal fixation of the fracture of the clavicle if necessary [7]. Reduction and stabilization of scapular fracture in our patient was performed first before the clavicle fracture due to the presence of significant displacement.

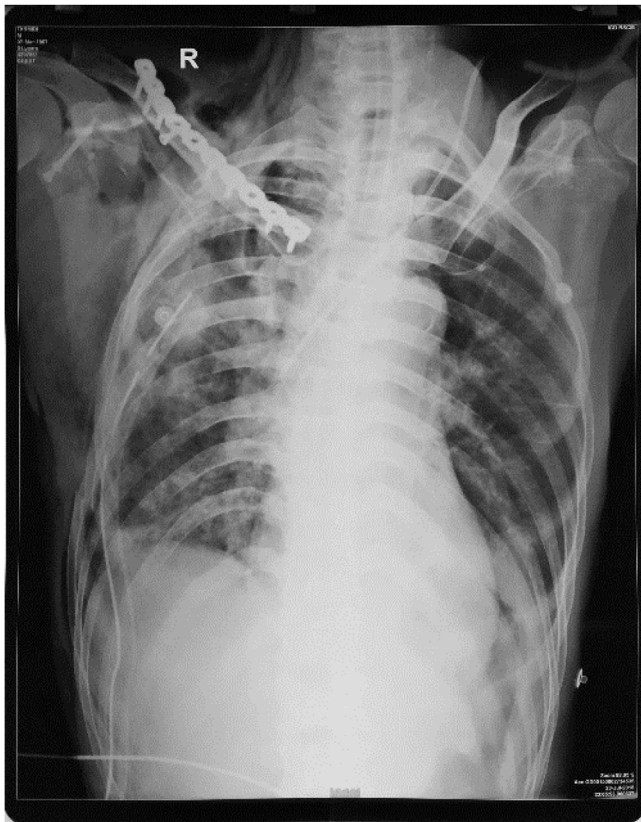


Fig. 4. AP X-Ray of the Shoulder. It showed the lag screw and the plate and screw appeared well seated to reduce the scapular and clavicular fracture, respectively.

Patients diagnosed with floating shoulder should undergo surgical treatment, with the aim being to restore the joint anatomy and function, allows for early motion and effective physiotherapy exercises of the shoulder. The indication for performing operation in the case floating shoulder is if the case is presented with a displaced intra-articular fractures, fractures of the glenoid rim with humeral head subluxation, or unstable fractures of the scapular neck [8].

The application of this ETC was supported by a study by Vallier et al. who concluded that definitive management of mechanically



Fig. 5. X-ray of the patient 1 year to follow-up.

unstable fractures of the axial skeleton and long-bones within 36 h of injury as long as the patient has demonstrated response to resuscitation as based on improvement of acidosis with lactate < 4.0 mmol/L, pH \geq 7.25, or BE above 5.5 mmol/L was recommended [9]. Patients with multiple injuries are classified into stable, borderline, unstable, or in extremis. Early definitive fracture fixation in ETC is recommended for stable patients, as well as borderline and unstable patients who respond well to resuscitation treatment. In those with severe hemorrhagic shock or any other life threatening conditions, prolonged surgical procedures should be avoided, and the patient treated with staged fracture fixation instead. In these patients, the damage control approach using external fixation is recommended. In patients



Fig. 6. Patient's clinical outcome showing an improvement in ROM.

with borderline state or in poor condition, a multi-disciplinary approach to determine the best musculoskeletal treatment is advised [10].

We used ETC approach in treating this patient. As stated, this ETC permits for efficient employment of the orthopaedic surgeon and operating room staff and allows prompt mobilization to perform any tests and therapies for the patient.

9. Conclusion

Early total care for polytrauma patient suffering from floating shoulder is the appropriate choice of treatment, allowing prompt mobilization and therapy of the patient.

Declaration of Competing Interest

None.

Funding

None declared.

Ethical approval

Ethical approval has been received from Cipto Mangunkusumo Hospital, Jakarta, Indonesia.

Consent

Written informed consent was obtained from the patient's parents for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

Author contribution

Husnul Verdian: Wrote the manuscript, Provided revision to the scientific content of the manuscript, Data collection, Data analysis and interpretation.

Ismail Hadisoebroto Dilogo: Performed the surgery.

Registration of research studies

Not Applicable.

Guarantor

Ismail Hadisoebroto Dilogo.

Provenance and peer review

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