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# Complex gunshot injury to the heart as a consequence of suicide attempt in a schizophrenic patient

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ABSTRACT

*INTRODUCTION:* Self-inflicted gunshot injury to the heart is uncommon in Western Europe countries. However it is considered to have a high mortality through cardiac tamponade or exsanguination and concomitant chest or abdominal cavity injury.
*CASE PRESENTATION:* We present a 39-year-old schizophrenic woman who attempted suicide with the aid of a 6.35 mm caliber handgun, after self-discontinuing of antipsychotic treatment. Lower third of sternum, right heart atrium and ventricle and inferior caval vein were hit by the bullet which consequently got lodged in the right paravertebral muscle mass at the lower thoracic vertebral level. As she was hemodynamically unstable due to hemopericardium and a huge right hemothorax, she underwent emergent surgery. Heart and inferior vena caval injuries were repaired on extracorporeal circulation. The postoperative course was uneventful and she was transferred to a psychiatric facility on the 7th postoperative day. One year after the surgery she is well, compliant to antipsychotic medications and on periodic follow-up by psychiatrists.
*CONCLUSION:* This case represents management of complex self-inflicted gunshot cardiac injury in a schizophrenic patient who discontinued antipsychotic medication. Liaison between themedical rescue service and high level trauma center essentially reduced injury-to-surgery time. Complex heart injury was successfully repaired on extracorporeal circulation.



## 1. Introduction

Unlike other penetrating chest trauma, the hyperkinetic projectile gunshot injuries are prone to cause complex heart injury or concomitant chest/abdominal injury [1]. Therestrictive firearm laws reflect low rate of self-inflicted gunshot trauma in Western Europe countries. Up to 40% of schizophrenic patients have got history of suicide attempt. However, the use of firearms in suicidal intent is rare [2,3].

## 2. Case presentation

A 39-year-old schizophrenic lady attempted suicide when she discounted psychiatric treatment for two weeks. She shot herself with 6.35 mm caliber Browning handgun pointed to her chest. This happened at home using her husband's legal firearm. She was fully conscious but severely hypotensive when the ambulance service team arrived. She was immediately intubated at the scene, volume resuscitated and catecholamine commenced to maintain organ perfusion pressure and were quickly transferred by helicopter to the emergency room (ER) of our hospital. Injury-to-gate time was 78 min (87 km transfer distance) and cardiothoracic team was alerted and on standby. On admission to ER she was stabilized on low-to-medium catecholamine support (norepinephrine 0.15 ug/kg/min), sedated and mechanically ventilated. A gunshot wound was evident in the lower third of the sternum (Fig. 1) and surprisingly the projectile was felt on deep palpation at the level of the right 9th rib paravertebrally. Chest and abdominal CT scan revealed a moderate volume hemopericardium (≈13 mm), a huge right hemothorax and a metallic projectile located in thebody of the right paravertebral muscles at the level of the fractured the 9th rib (Figs. 2 and 3). Emergent surgery through median sternotomy was performed; 300 ml of blood was evacuated from pericardium and 800 ml from the right pleural cavity. The projectile trajectory fractured lower third of the chest bone, punctured the anterior walls ofthe right ventricle and right atrium and perforated inferior vena cava. The bullet was finally lodged inthe paravertebral muscle at the level of the right 9th rib. Due to the complex nature of the cardiac injury and profuse bleeding from inferior vena cava, the injuries were repaired on extracorporeal circulation with bicaval cannulation without cardiac arrest (Fig. 4). Wounded free wall of the right atrium and ventricle were sutured with four interrupted 4/0 polypropylene stitches buttressed by pericardial strips, and

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**Fig. 1.** Gunshot wound situated in the middle third of chest bone.

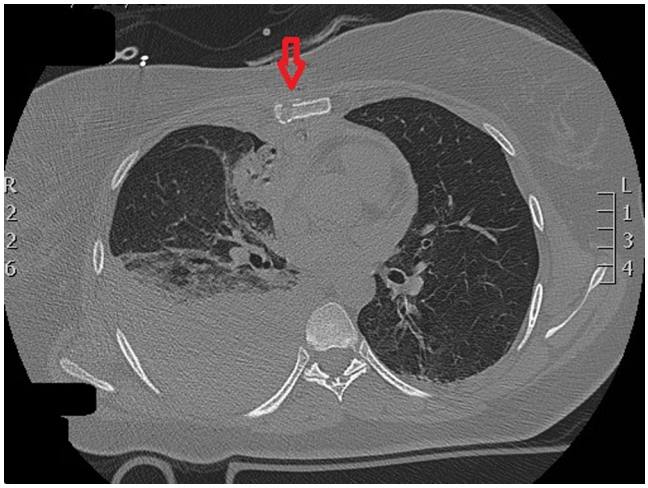

**Fig. 2.** CT scan: moderate hemopericardium(13 mm) and huge right hemothorax (65 mm).

consequently the defect in the inferior caval vein was closed with continuous 5/0 polypropylene stitch (Prolene™, Ethicon, UK). No trauma to the right lung was seen and the projectile was removed. The postoperative course was uneventful and she was transferred to the psychiatric facilityon the 7th postoperative day. One year after the surgery she is well, compliant to antipsychotic medications and on periodic follow-up by psychiatrists.

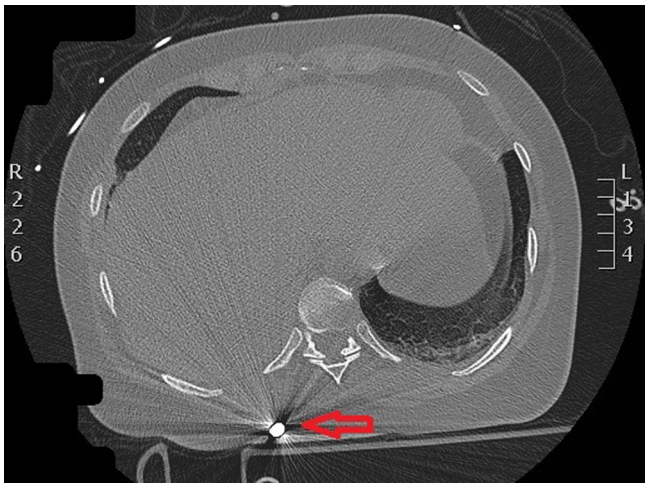

**Fig. 3.** CT scan: projectile lodged in the paravertebral muscle mass at the level of the right 9th rib.

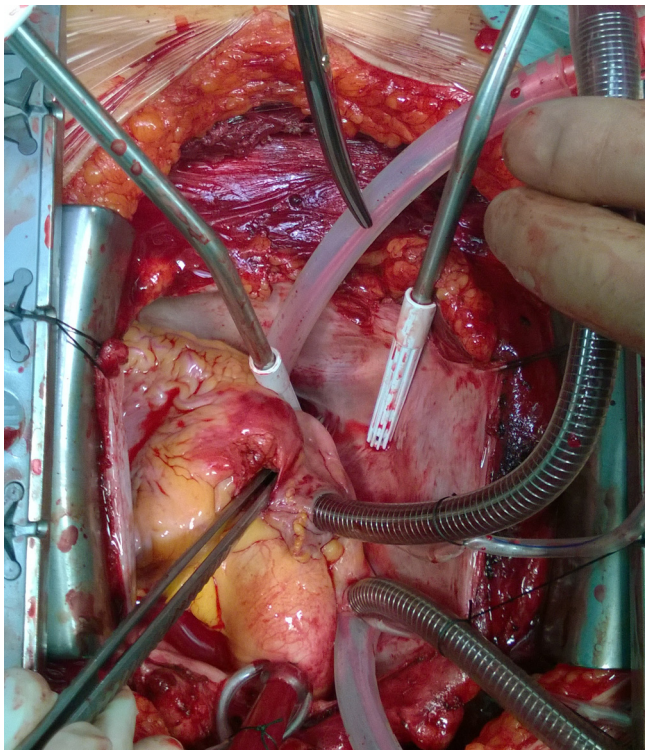

**Fig. 4.** Right ventricle and right atrium free wall shot injury. Bicaval cannulation for extracorporeal circulation.

## 3. Discussion

Chest or upper abdomen gunshot wounds need to be suspected along with the cardiac injury in these instances [1,4,5]. There is a considerable risk of concomitant chest or abdominal cavity injuries due to high kinetic energy of the projectile or secondary injuries due to high velocity bone fragments [6]. Furthermore, gunshot injuries are prone to be complex: they create septal shunts, disrupt valves or papillary muscle apparatus, or might lacerate coronary arteries, particularly the left anterior descending artery (3–9% of all cases)[5,7]. If the gunshot is located at the front of the body, the right ventricle injury dominates followed by the injury of left ventricle, right atrium, and great vessels [1,2]. Scoop and run approach including prompt diagnosis, speedy transportation and emergent

surgery are paramount factors for a favorable outcome of penetrating cardiac injury victims [5]. Pericardial effusion (>5 mm) confirmed by sonography and CT-angiography in thoracic penetrating trauma are indications for surgical heart exploration [8,9]. In case of refractory hemodynamic instability in penetrating chest trauma, emergency department thoracotomy is justifiable in an attempt to relieve cardiac tamponade or to control bleeding [10,11]. The mortality remains high; in non-selected cohorts it reaches 80%–94% [5,12]. Hemodynamic instability, cardiac arrest and prolonged injury-to-gate time were identified to be independent risk factors for death [13]. On the other hand, 80%–96% survival rate were reported in patients who were primarily revised by cardiothoracic surgeon [14]. Midline sternotomy, routine heart surgery experience, and availability of extracorporeal circulation increase the chance to survive gunshot heart injury [9,14]. Nevertheless, it requires immediate transfer of victims to high level trauma center with cardiothoracic surgery background [4,9,7]. Suicide is the major cause of premature death in patients with schizophrenia. Among these patients, 40% report suicidal thoughts, 20%–40% make unsuccessful suicide attempts, and 9%–13 % end their lives by suicide [2]. Young age, depression, alcohol or drug misuse, history of prior suicide attempt and discontinuation of antipsychotic medications are the major risk factors for suicide among individuals with schizophrenia [15]. More than 85% of schizophrenic patients end their life by jumping from a height or by jumping in front of a moving vehicle. The use of firearm is uncommon, particularly in states with strict gun laws [3].

## 4. Conclusion

The risk of suicide attempt among schizophrenic patients is evident. However, the use of firearms in suicidal intent is rare, particularly pointed at the heart. This case represents successful management of complex gunshot cardiac injury in a schizophrenic patient who attempted suicide after self-discontinuing of antipsychotic treatment. Tight cooperation between rescue medical service and high level trauma center played important part in shortening injury-to-surgery time. Complex cardiac injury was successfully repaired on extracorporeal circulation. Presented case has been reported in the line with the CARE criteria [16].

**Informed consent**

Authors declare granted permission by Mrs. J.M. for publication of the case.

## Author contribution

Jakub Konecny – writing, corresponding author, photos, manuscript revision.

Ales Klvacek – writing.

Martin Simek – writing.

Vladimir Lonsky – managed the patient as attending and indicating consultan.

Petr Santavy – managed the patient as attending and indicating consultan, performed the surgery

All authors read and approved the final manuscript.

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