

## CLINICAL STUDY

**Penetrating cardiac injury**

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**Penetrating cardiac injury is still a diagnostic problem at this time. The authors want to show the breadth of problems on the case histories of two patients. It is important to classify the patients according to their risk group, and then to proceed. In each suspicion of cardiac injury we started with thoracotomy. It is an important „life endangering thoracotomy in emergency room“. The hypotension with abdominal symptoms was started with laparotomy. Transdiaphragmatic pericardiotomy is a helpful adjunct in the decision as to whether proceed to median sternotomy. (Tab. 2, Fig. 3, Ref. 7.)**

**Key words:** penetrating cardiac trauma, gunshot wounds, stab wound, hypovolemic shock, thoracotomy, laparotomy.

In 1885, Billroth stated that „the surgeon who should attempt to suture a wound of the heart would lose the respect of his colleagues.“

Pages reiterated this in 1896. According to him: „no new method can overcome the natural difficulties that attend a wound of the heart“ (3).

Paradoxically, the first reported successful repair of cardiac injury was performed in the same year 1896, when Rehn of Munich was forced to place three silk sutures to a 1.5 cm right ventricular stab wound of a discharged soldier.

The first reported repair of a cardiac wound in the United States was performed by brothers L.L. Hill and R.S. Hill in 1902, when they operated on a kitchen table in Alabama (5).

The attitude of observation and waiting was changed to active operative after the turning of the century.

Penetrating cardiac injuries are still a challenge for surgeons because of their difficulty as to the diagnosis, had prognosis, and the necessity of accurate operation.

We want to underline the core of this problem in our own cases and the recent opinions on this problem.

**Case report**

1. A 25-year old suffered a gunshot wound while cleaning his gun on September 13, 1998. The shot of the average 1 cm bullet started 3 cm left from the processus xyphoideus and ended left in the lumbar area. On arrival, the patient was orienta-

ted, conscious, blood pressure was 140/80 Torr, heart rate was 90 beats per minute, sweaty skin, satO<sub>2</sub> 99 without inhalation of O<sub>2</sub>, abdomen with pain, tender, heavy and palpable.

We indicated an operation according to the type of injury. After a chest x-ray film at the operating room (Fig. 1) and the developing shock, the operation started by midline sternotomy and then laparotomy. During the operation we found out that the gun had shot the auricle of the heart, left lobe of the liver, front and back wall of the stomach.

The called-in urologist did not indicate nephrectomy on the left.

We found extensive fluid collection in CT on the 5th day after operation (Fig. 2). Reoperation was indicated for the possibility of injury of the retroperitoneal part of duodenum, and we performed gastroenteroanastomosis. We introduced a urologic catheter into the lesion of renal pelvis on the left and the cavity of abdomen was cleaned up and drained.

The collection in the area of the left kidney in CT control was still present on the tenth day after operation.

The second reoperation involved nephrectomy of the left kidney. We repeated CT for the persistence of septic state on the

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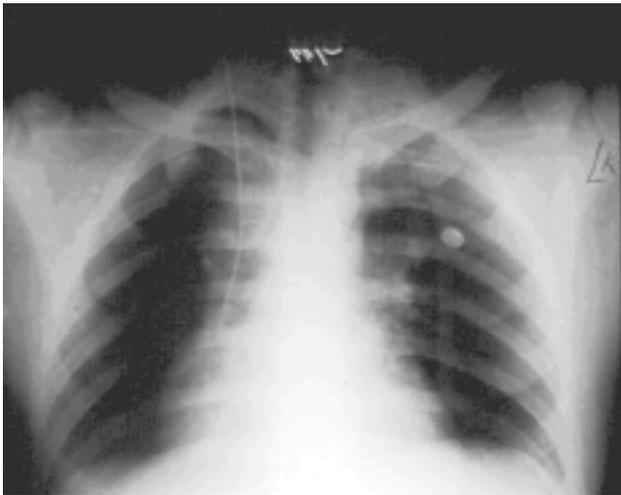


Fig. 1. X-ray of thorax of the first patient in shock.

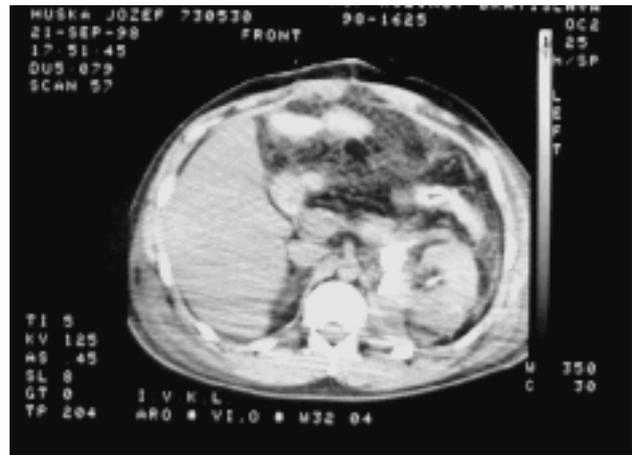


Fig. 2. CT of the first patient after operation.

fourteenth day after operation. We found persistent fluid collection. We evacuated the hematoma of retroperitoneum by laparostomy.

Tab. 1. Hospital survival rates (Rhee, 1998).

| Year | Duration (years) | Location                    | Author                  | Cardiac injury (n) | Overall (%) | GSW (%) | SW (%) |
|------|------------------|-----------------------------|-------------------------|--------------------|-------------|---------|--------|
| 1995 | 3,5              | Sao Oando, Brazil           | Coimbra et al.          | 63                 | 35          | 17      | 61     |
| 1994 | 6                | East Bay, Calif.            | Henderson et al.        | 215                | 15          | 6,5     | 37     |
| 1994 | 5,4              | Johannesburg, South Africa  | Velmahos                | 373                | 81          | 49      | 87     |
| 1993 | 12               | Oslo, Norway                | Aksnes et al.           | 9                  | 66          | 0       | 86     |
| 1993 | 15               | Jackson, Miss.              | Mitchell et al.         | 119                | 58          | 44      | 78     |
| 1993 | 3                | Caminas, Brazil             | Rivoli et al.           | 26                 | 82,6        | 50      | 94     |
| 1992 | 2                | Parrow Valley, South Africa | Knott-Craig             | 129                | 91,5        | N/A     | 91     |
| 1992 | 6                | Minneapolis, Minn.          | Blake et al.            | 48                 | 65          | 60      | 35     |
| 1991 | 13               | Baltimore, Md               | Attar et al.            | 109                | 61          | 40      | 78     |
| 1991 | 12               | Charleston, SC              | Kaplan et al.           | 48                 | 44          | 32      | 54     |
| 1991 | 6,5              | Denver, Colo                | Honigman et al.         | 70                 | 30          | 6,5     | 49     |
| 1990 | 4                | New Delhi, India            | Kuishrestha et al.      | 11                 | 91          | 100     | 86     |
| 1990 | 7                | Jamaica                     | Mc Fariane and Broadway | 33                 |             |         |        |
| 1989 | 12               | Los Angeles, Calif.         | Mandal and Oparah       | 105                | 82          | 76      | 89     |
| 1989 | 12               | Beirut, Lebanon             | Jebaramand Saade        | 49                 | 63          | 63      | N/A    |

GSW — gunshot wounds, SW — stab wounds, NA — not applicable

2. A 16-year old patient was stabbed with a metal pole while diving. Upon arrival he was alert, in shock, haemothorax bilateral and a chest radiograph showed an enlarged heart shadow. During the operation we found holes in right auricle, which we sutured. We found a lesion of strain arteria pulmonalis which was sutured by Satinsky clam.

The patient was released home in good condition after the sternotomy had healed.

## Discussion

Most patients with penetrating cardiac injuries die before arrival to hospital (2).

Only 20 % of patients with penetrating wounds of the heart reach the hospital alive and the clinical studies of heart wounds are therefore, highly selective (4). Therefore, 80 % do not reach the hospital alive.

The extent of survival after penetrating cardiac injury according to the authors and literature is in Table 1 in system of care and hospital — based data.

The analysis of P.M. Rhee from trauma centers showed a hospital survival from 15.3 % to 91.5 %, on average 42.7 %. The best results are from the regions, where pre-hospital care is least unfolded. Paradoxically, a good unfolded pre-hospital care lowers the hospital survival (5).

Roger Saadia divided the patients with heart and abdomen injury into two basic groups:

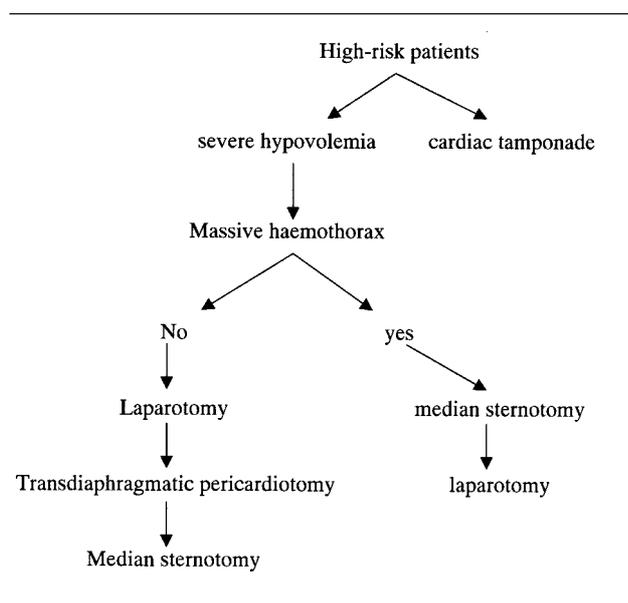
- A) Low-risk group — a single high epigastric stab wound,
- B) High-risk group — multiple stab wounds or single or multiple gunshot wounds.

It is important to distinguish heart injury in low-risk patients of the first group: cardiorrhaphy must be tackled before laparotomy (6).

Suspicion of heart injury with the injury of the thorax is according to Figure 3 in the area of the dangerous zone (7).

The management algorithm in high-risk patients in B group is in Table 2.

**Tab. 2. Algorithm for the treatment of „ high- risk“ patients presenting with signs of life.**



The clinical diagnosis is difficult. The picture of cardiac tamponade or haemothorax can be masked by a large haemoperitoneum. In the emergency room, we should make the first differential diagnosis, and if we need an emergency thoracotomy in the emergency room thoracotomy (6). This aggressive procedure can rescue 2/3 of young people (7).

It is better to start with thoracotomy even with haemoperitoneum for:

1. A tamponade and the repair of the heart we can be achieved relatively quickly.
2. A typical picture of the tamponade of the heart is not usually associated with a large haemoperitoneum (6).

In the majority of cases, physical examination, chest and abdomen roentgenogram and echocardiography are sufficient for the diagnosis. Pericardiocentesis should be performed immediately upon suspicion of acute cardiac tamponade, removal of an even small amount of fluid can save the life (3).

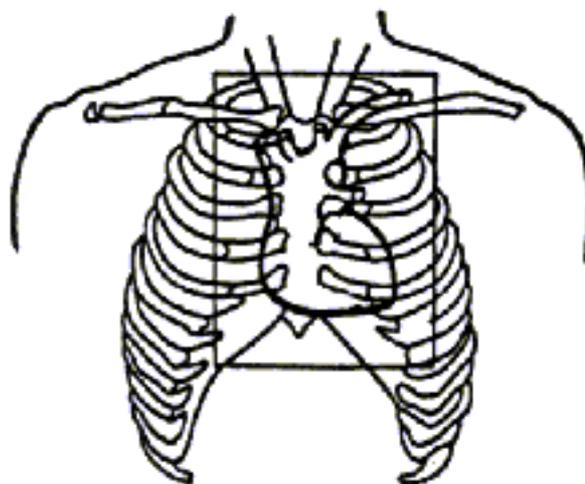
The routine administration of large volumes of crystalloid should be avoided as this may worsen the haemorrhage or tamponade, without improving the tissue perfusion (1).

Penetrating cardiac injuries are associated with high mortality, which has improved only minimally in the past three decades despite the institution of an efficient pre-hospital system and modern technological advances (4).

The presence of hypovolaemic shock with a distended abdomen compels for laparotomy. When thoracic injury is involved, we should consider the possibility of heart injury.

Transdiaphragmatic pericardiotomy can help prior to sternotomy (6).

Thoracotomy due to penetrating heart injury is an important component of rescue and acute care.



**Fig. 3. The dangerous zone of the thorax.**

Thoracotomy, in the emergency room“ or the operating room remains to be „conditio sine qua non.“

It is necessary to assess completely the ultimate survivability of penetrating wounds in the heart (5).

Hospital care of new era of knowledge should secure, space, material and personell in order to treat efficiently the patients with heart injuries.

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Received May 28, 2001.  
Accepted September 12, 2001.