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Inferior vena cava injuries: A case series and review of the South African experience

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ABSTRACT

Introduction: Penetrating injury may involve the major vessels in the abdomen. Injury to the abdominal inferior vena cava (IVC) is uncommon and is usually caused by gunshot wounds. Mortality from IVC injuries is high and has changed little over time.
Aim: The aim of the study was to report a series of IVC injuries from an urban trauma unit and to compare this with reports from similar institutions.
Method: A retrospective review of penetrating abdominal injuries at Kalafong Hospital from 1993 to 2010 was performed. All cases of injury to the IVC were retrieved and the following data recorded: patient demographics, incident history, origin of referral, description of the IVC injury, associated injuries, operative management, hospital stay and outcome. The results were compared to those from similar institutions.
Results: Twenty-seven patients with IVC injuries were treated. All were caused by gunshot wounds, and all had associated intra-abdominal injuries. The majority (56%) of injuries were infrarenal. The injury was managed most commonly by venorrhaphy and, when successful, all the patients survived. A third of patients with infrarenal injuries died, some after exploration of a stable peri-caval haematoma. Ten of the patients died (37%), half of them during surgery. These results are similar to those from similar institutions from earlier time periods.
Conclusions: This report concurs with other studies. IVC injury carries a high mortality rate and that this has not improved over several decades. Less aggressive management of some stable patients or stable injuries is proposed by the authors for possible improvement of the mortality rate.

Background

Penetrating abdominal trauma is a certain component of the practice of the urban trauma unit. Knives are ubiquitous and handguns are readily available in many countries. The large vessels in the abdomen are uncommonly involved in such injuries. Most injuries to the IVC are due to gunshots. Injury to the abdominal inferior vena cava (IVC) has a peculiar presentation and requires specific surgical management. This is because of the low intraluminal pressure of the IVC and its relatively thin wall. In addition, the superior part of the IVC is located close to its final ingress to the heart and is relatively inaccessible to the surgeon. Injuries to the IVC carry a high mortality rate, ranging up to 65% [1]. This is partly due to associated injuries. Approximately 30–50% of patients do not reach a hospital, and about 30% of those that do, die as a result of their injuries [2]. The mortality rate of IVC injuries has changed little over time and surgical approaches seem to have stagnated [3]. Reports on management of these injuries remain important in order to discern any possible improvement in logistical or surgical management.

Aim

The aim of this study was to report on the experience of an urban trauma unit in the management of penetrating IVC injuries, and to compare this with reports from similar institutions.

Setting

Kalafong Hospital is a regional general hospital situated in The Tshwane Metropolitan region and forms part of the training platform for the University of Pretoria. It has a level II trauma service.

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Patients and methods

A retrospective review was performed of abdominal injuries treated at Kalafong Hospital in which the IVC was involved. The study spanned a period of 17 years from 1993 to 2010. The departmental records database was searched for cases of trauma laparotomy, as well as for the ICD 9 code for IVC injury, 902.1. Data were collected regarding patient demographics, incident history, origin of referral, description of the IVC injury, associated injuries, operative management, hospital stay and patient outcome. Initial management was according to standard Advanced Trauma and Life-Support (ATLS) guidelines. The decision to perform a laparotomy was based on haemo-dynamic instability despite, or after, initial fluid resuscitation, and/or signs of peritonism. No preoperative imaging studies were performed. Initial management of the patients was by surgical registrars. Consultants were called when registrars found this necessary and this occurred intra-operatively in most cases. Access to the abdomen was through a long midline incision. In cases with active haemorrhage from the retroperitoneum control was attempted with direct pressure to the area of injury, which was then explored. In addition, all zone 1 retroperitoneal haematomas were explored, as per departmental protocol. Operative procedures on the IVC were venorrhaphy when possible, or ligation. Uncontrollable bleeding was managed by packing. Patients were managed postoperatively in the intensive care unit whenever possible, beds in the ICU being at a premium.

Results

Twenty-seven patients with IVC injuries were treated during the study period, representing 0.5% of trauma laparotomies. There were 24 males and 3 females with an average age of 30.6 years, 22 (81%) being below the age of 40 years. Nine of the patients (33%) had been transferred from peripheral hospitals – all by road ambulance, for distances of 50–200 km. All injuries had been caused by shots from handguns. It was not usually possible to obtain information regarding the calibre of the guns in most cases. Entrance wounds were in the epigastrium in 17 cases, the back 5 cases and the chest in 4 cases.

There were associated intra-abdominal injuries in all cases. All patients sustained hollow visceral injuries: small intestine in 16 (64%) and colon in 10 (40%). Solid organ injuries occurred in 14 (52%) of patients, being mainly to the liver in 11 patients (41%), but also the pancreas and kidneys. Six patients (22%) had associated major vascular injuries.

The surgical procedures performed are shown in Table 1. Venorrhaphy was performed most commonly. In 4 cases the IVC was ligated below the renal veins. Interposition synthetic grafting was performed in 1 case for a suprarenal injury. Packing only was performed in 2 patients with associated liver injuries, and in one other patient.

The anatomical distribution of the IVC injuries is shown in Table 2 together with the mortality for each region. Injuries were classified as infrarenal, suprarenal and retrohepatic. The majority (56%) of the injuries were infrarenal, and these patients had the best survival. Nevertheless, 5 of the 15 patients (33%) died.

Table 1
Mortality in relation to the operative management of IVC injuries in 27 patients.

Procedure	Number	Mortality *n* (%)
Venorrhaphy	14	0 (0)
Venorrhaphy and packing	2	1 (50)
Ligation	4	2 (50)
Attempted control/exsanguination	5	5 (100)
Packed	1	1 (100)
Synthetic graft repair	1	1 (100)
Total	27	10 (37)

Table 2
Mortality in relation to the site of IVC injury in 27 patients.

Site of injury	Number	Mortality *n* (%)
Retrohepatic	3	3 (100)
Suprarenal	9	2 (22)
Infrarenal	15	5 (33)
Total	27	10 (37)

The management and mortality rates of the infrarenal injuries are shown in Table 3.

The overall mortality in this series was 37% (10 of 27 patients). Half of the deaths occurred during surgery and the rest postoperatively in the ICU, except for 1 late death from sepsis after 77 days. The three patients with retro-hepatic IVC injuries all died, 2 intra-operatively and 1 later in the ICU. Five of the six cases with other major vascular injuries died. The only survivor was a patient who had concomitant injuries to the common iliac veins. These were sutured and the IVC ligated. In cases where venorrhaphy alone could be performed successfully all the patients survived. These were all infrarenal injuries. Four of the 9 patients transferred from distant hospitals died (44%). However 2 had retrohepatic injuries and 1 a suprarenal injury. The other patient exsanguinated in theatre from an infrarenal injury after a 200 km road transfer. All the patients who were discharged from the ICU survived. The average hospital stay for patients who survived was 13.9 days.

Discussion

This report from an urban regional hospital shows a great deal of consistency with similar reports in the literature. Four previous reports from South Africa are of similar size but from different time periods. Two reports from Durban were on 28 patients in the 1980s and 26 patients in the 1990s [4,5]. The report from Baragwanath Hospital in Soweto in the 1990s was on 74 patients [6]. The current study and the one from Cape Town [7] straddled the two centuries. The 5 studies are compared in Table 4.

Remarkably, the current series contains only cases of gunshot injuries. No IVC stab wounds or blunt injuries were managed during this period. The earlier series from Durban contains 53% stab wounds [4]. The proportion of gunshot wounds to the IVC in these reports has clearly increased over time indicating that handguns have become more freely available (Table 4). Nevertheless, gunshot wounds predominate in reports of the IVC injury, irrespective of era or origin (reviewed by Huerta et al.) [2]. More recently, cases of IVC injury for inclusion in this study have all but dried up because there has been a dramatic decrease in penetrating injury due to interpersonal violence in our practice. The period spanned by this study was characterised by a virtual epidemic of gunshot wounds. This is apparent also in the other South African studies from the 1900s and early part of this century, which show a predominance of gunshot wounds (Table 4).

The reports from South Africa all show the same predominance of young males and anatomical distribution of IVC injuries,

Table 3
Management and mortality in infrarenal IVC injuries in 15 patients.

Procedure	Number (%)	Mortality: number (%)
Venorrhaphy	8 (53)	0
Venorrhaphy + packing	1 (7)	1 (100)
Ligation	4 (29)	2 (50)
Failed control	2 (14)	2 (100)
Total	15	5 (33)