



Selective Conservatism in Trauma Management: A South African Contribution

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Abstract. Trauma in South Africa has been termed the malignant epidemic [1]. This heritage was the result of a violent colonial legacy [2] which spawned the apartheid system of injustice and the struggle against it [3,4]. The Apartheid regime created overcrowding, unemployment, social stagnation, and the disruption of normal family life. These were the catalysts for the incredible amount of criminal and interpersonal conflict in South Africa over the last 50 years. African townships such as Soweto in Johannesburg and Umlazi in Durban were crime-ridden ghettos where the apartheid police were more interested in fueling the “black on black” violence rather than trying to curb it. Baragwanath (Chris Hani-Baragwanath) and King Edward the VIII Hospital in Durban were the “trauma care epicenters” on the fringes of these huge urban conurbations. Both were designated black hospitals and both were underfunded and dilapidated. Even the architecture was similar, with prefabricated, poorly ventilated structures serving as wards and clinics in both institutions. Trauma volumes consisted of between 10 and 20 laparotomies on weekend nights at the height of political unrest. This led to vast individual experience in several areas of trauma typified by Demetriades’ experience with 70 penetrating cardiac injuries [5]. In this setting of limited resources and an overwhelming volume of trauma, selective conservatism as a surgical philosophy took root and has profoundly influenced the way the world manages trauma. We detail and illustrate the evolution of this approach and its continued application.

Selective conservatism is not a new concept. By necessity in the pre-anaesthetic era it was practiced for centuries with few survivors [6]. It was called into question only in the late 19th century and early 20th century when the mass casualties of modern warfare and advances in surgical and anaesthetic techniques swung the pendulum to an operative approach. This dominated surgical practice until the 1960s when Shaftan [7,8] reintroduced the concept and described the successful nonoperative management of penetrating abdominal wounds. Both well-funded and resource-poor centers, some dealing with high volumes of blunt and penetrating trauma, now advocate this policy [9–14].

What does selective conservatism mean? It has more facets than simply not operating on selected individuals. The primary

elements are clinical observation and re-evaluation. The first decision point is whether to intervene or continue observation and investigation. This decision is tempered by the knowledge that an intervention, either diagnostic or therapeutic, may do more harm than good. Therefore, the question must be: Is an intervention truly necessary? If the answer is yes then we need to decide what intervention is appropriate and whether a simple option would suffice instead of a complex operation. We ask these questions on a daily basis and they remain the key elements of this approach. This has generated observational studies, retrospective audits, prospective audits, and comparative studies. We present some of these to illustrate and substantiate the value of this approach in different anatomical regions and how it has developed with emerging technology.

Until the mid-1980s these studies were based almost exclusively on injuries inflicted by stab wounds. Since then there has been a significant change in the nature of penetrating trauma in South Africa as typified by the reports from clinical and forensic audits [15, 17–17]. From 1983 to 1992 [15] 2500 penetrating torso injuries were treated annually. Over that decade stab wounds declined by 30% but firearm wounds increased by 873% with a mortality rate of 1.6% for stabs and 12.5% for firearms. This has prompted us to review our approach to these problems to see if the principles of selective conservatism need to be modified when applied to firearm injuries.

Penetrating Neck Trauma

The high concentration and intimate relationship of vital structures in the neck meant that most surgeons felt that exploration was mandatory for any injury that penetrated the platysma muscle. The natural history and the results of a selective policy were documented at Baragwanath [18]. In 1980 [19] over a six-month period 108 patients admitted to King Edward the VIII were prospectively evaluated. Exploration was undertaken only for hard clinical or radiologic signs of vascular or aerodigestive injury. Only 26 were explored of whom two died. In the conservative group one died from an associated thoracic injury. This concept of nonoperative management was again analyzed in a cohort of

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109 patients [20]. None other than nine with vascular injuries underwent exploration. Although 22 had suggested esophageal injury by the presence of free prevertebral air only four had confirmed esophageal injury on contrast study. All four were managed non-operatively with fine-bore nasogastric feeding until radiologic resolution on the leak. This approach was again ratified in a larger series [21] of 1358 patients with neck injuries over five years. Two hundred twenty presented with odynophagia, of whom 28 had confirmed esophageal injury with 17 managed non-operatively with no deaths and only minor local sepsis. In short, active bleeding needs an immediate operation. Investigation of those with a high clinical risk of injury will reveal those vascular injuries requiring operation. It also defines those esophageal injuries which, if confined to the neck with a minimal leak, can be safely managed non-operatively.

Chest Trauma

Traditional teaching preached that all but tiny chest collections resulting from penetrating trauma needed tube thoracostomy. Several challenged this dogma [22–24]. Muckart and Luvuno [23] prospectively collected a series of chest stabs in which only significant collections (a pneumothorax greater than 2 cm or a hemothorax above the angle of 7th rib in the axillary line) were drained. Of the 251 patients, 166 fit the criteria for immediate drainage. Eighty-five did not fit the criteria and were observed initially. Only seven required delayed drainage; the other 78 were discharged the following day without any intervention. They had convincingly demonstrated that this policy was safe and effective. Hirschberg then showed the reliability of physical examination to detect large collections of fluid and hence predict the need for drainage with a sensitivity of 96% and a specificity of 93% [25,26]. All is easy when the clinical findings and the radiographs are typical, but what if they do not match correctly? We needed to know where we went wrong. A subsequent analysis was undertaken of a consecutive cohort of 234 penetrating chest injuries presenting to one surgical unit over a six-month period [27]. We identified the pitfalls of penetrating chest trauma. Vascular, cardiac, and diaphragmatic injuries were the occult injuries, easily overlooked unless specifically thought of and sought. The results of this policy in the firearm era in a cohort of 586 patients showed a different spectrum of damage and pleural collections in those with firearm injuries who reached the hospital. The firearm injuries had fewer pneumothoraces and more pulmonary contusions than the stabs, but the policy of selective pleural drainage continued to be effective [24].

Penetrating Abdominal Injuries

A penetrating stab wound of the abdomen has a 5%–60% chance of injuring a vital intra-abdominal organ, with the risk being lowest at the back and highest anteriorly. Subjecting all patients to celiotomy is unnecessary in one third of the cases and carries a considerable risk of morbidity and even mortality. Shaftan and Nance were the first to advocate a policy of selective exploration in civilian populations in the United States [7,8,11]. However, the fear of missing an injury prevented many surgeons from acting on this insight. At Baragwanath and King Edward the VIII hospitals, in the face of ten or more penetrating stab wounds a night, surgeons had to be more selective as they could not afford the luxury

of routine exploration. They elected to operate only in the presence of hard signs. The approach was bred by necessity; those who practiced it knew it worked and eventually they presented evidence to support this. Initially, it was reported as an audit from Baragwanath [10]. Over seven years 646 patients with abdominal trauma were treated in one of the five surgical units. Of these 85% were a result of stabs, 50% of whom were managed nonoperatively with no deaths and a 2.4% complication rate. Of the operated individuals, 38 had a nontherapeutic laparotomy, 21 of whom had an eviscerated omentum as the sole indication for surgery. Could these individuals have also been spared a nontherapeutic laparotomy? This led to the eviscerated omentum being the subject of a prospective evaluation in 276 patients over a three-year period [28]. The findings at laparotomy were used as the arbiter of the clinical prediction of the need for a therapeutic laparotomy. They concluded that local exploration, amputation of the omentum, closure of the fascial wound, and observation thereafter was safe. The initial experience with selective exploration for anterior stab wounds was further documented [29] and its application to manage posterior wounds was also proven [30]. Subsequently, selective conservatism has been extended to firearm wounds and has been shown to be a safe and effective strategy. Twin papers from King Edward [12] and Baragwanath [14] showed it to be practical, and further data from Demetriade's group has confirmed its role in the U.S. [9]. It must be remembered, however, that critical to the successful implementation of a conservative management policy is adherence to the rules of engagement. Failure to follow basic guidelines has resulted in avoidable mortalities [31].

Pancreatic Trauma

A variety of approaches to pancreatic trauma have been expounded in the literature, some advocating complex surgical solutions. The results of a conservative, largely non-resectional approach has been well documented [32–36]. This is best summarized in Madiba's study that shows a favorable prognosis after surgical drainage of gunshot, stab, or blunt trauma to the pancreas [32]. Even if a pancreatic fistula occurs, it can almost always be managed conservatively with a period of nutritional support [33].

Embolization Techniques

The philosophy of selective conservatism extends to therapy with the premise that a simpler therapeutic solution is better than a complex operative one. The late Professor Angorn was instrumental in delineating the arterial anatomy of the kidney [37]. Out of his work, which established that the renal blood supply is segmental, arose the concept of operative [38] and then angiographic embolization in the management of penetrating renal trauma [39]. This has been shown to be effective in both this institution and other centers. As these interventional skills developed, they have been applied in a variety of difficult clinical settings in trauma where control of continued surgical bleeding is problematic because of access to or gaining vascular control of the injury. These procedures are the natural extension of selective conservatism and have been elaborated on in specific anatomical regions, internal iliac injuries [40], facial injuries traumatic hemobilia [42,43], and the vascular tree in general [44]. More

recently vascular stents are being used selectively for traumatic arteriovenous fistula [45].

Colonic Trauma

The civilian management of colonic trauma evolved from the military experience of World War II by which it was considered mandatory to fashion a defunctioning colostomy in these patients. Young men who live in deprived communities have difficulty in coping with even a temporary stoma. In a busy black hospital in South Africa, primary anastomosis was performed by many surgeons to avoid stomas. This practice was eventually subjected to clinical audit in over 1200 cases [17] where it was found safe to practice it for the majority of patients. This has now been extended to the vast majority of colonic injuries, with only selected-destructive or rectal injuries requiring a colostomy. Another point assessed in the management of colonic trauma was the necessity and efficacy of intraoperative colonic lavage [46]. A large prospective randomized study compared lavage with no lavage in both primary closure and when the colonic wound was exteriorized. In this cohort of 389 patients, colonic lavage was shown to have no advantage and its use has been abandoned in trauma cases and increasingly abandoned in elective and emergency colonic surgery. The changing pattern of trauma from knife to firearm has led to a re-evaluation of strategies used for the management of colon injuries and their applicability to the generally more severe damage inflicted. Even in this setting primary repair with resection and anastomosis has been shown to be safe [47]. However, with the increased organ destruction produced by firearms came increased physiological disruption. This led to the implementation of damage control to prevent the patient exiting the physiological envelope of survival. These individuals require a damage control procedure. Control of contamination and of abdominal content containment require resection and the avoidance of primary reconstruction and stoma formation at the initial operation [48].

Colonic repair is extremely unlikely to breakdown if done in favorable physiological circumstances, and the vast majority of patients should be spared the burden and morbidity of a stoma.

Damage Control and the Plastic Bag

Abdominal content containment is an integral part of this damage control approach and simple solutions to prevent acute evisceration are required. The "Bogata" (plastic intravenous infusion bag) was a South American anecdotal solution [49]. The evaluation of abdominal content containment via the bag as a practical reality was undertaken in 157 patients. The meticulous audit of these patients documented for the first time its efficacy and the vagaries of its use. Refinement of this approach in reducing its morbidity has led to the development of the vacuum pack [50] and its commercial variants [51] which are the natural extension of the simple bag concept while minimizing its morbidity.

Conclusion

We believe that the selective conservatism approach has made a significant contribution to the management of the trauma victim. Although originally born out of necessity its merits and applicability remain pertinent in both resource-rich and poor

medical environments. Its continued development in the era of technical advances can only benefit patients [52]. Unnecessary or major operations may be avoided because a nonoperative or minimally invasive approach results in a better outcome for the patient.

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References

- Muckart DJ. Trauma—the malignant epidemic. *S. Afr. Med. J.* 1991;19(79):93–95
- Plaatjie ST. *Native Life in South Africa, before and since the European War and the Boer Rebellion.* London: PS King and Son, 1916
- Meli F. *South Africa belongs to us. A history of the ANC.* Harare: Zimbabwe Publishing House, 1988
- Nelson Mandela R. *Long Walk to Freedom. The autobiography of Nelson Mandela.* Randburg South Africa: McDonald Purnell, 1994
- Demetriades D. Cardiac wounds. Experience with 70 patients. *Ann. Surg.* 1986;203:315–317
- Kaufman J. *Musket-Ball and Sabre Injuries from the First Half of the Nineteenth Century.* Edinburgh: Royal College of Surgeons of Edinburgh, 2003
- Ryzoff J. Selective conservatism in penetrating abdominal trauma. *Surgery* 1966;59:650–653
- Shaftan GW. Selective conservatism in penetrating abdominal trauma. *J Trauma* 1969;9:1026–1028
- Velmahos GC, Demetriades D, Toutouzias KG, et al. Selective non-operative management in 1,856 patients with abdominal gunshot wounds: should routine laparotomy still be the standard of care?. *Ann. Surg.* 2001;234:395–402
- Stein A, Lisssoos I. Selective management of penetrating wounds of the abdomen. *J. Trauma* 1968;8:1014–1025
- Nance FC, Cohn I Jr. Surgical judgment in the management of stab wounds of the abdomen: A retrospective and prospective analysis based on a study of 600 stabbed patients. *Ann. Surg.* 1969;170:569–580
- Muckart J. Selective conservative management of abdominal gunshot wounds: a prospective study. *Br. J. Surg.* 1990;77:652–655
- Demetriades D, Rabinowitz B. Selective conservative management of penetrating abdominal wounds: a prospective study. *Br. J. Surg.* 1984;71:92–94
- Demetriades D, Charalambides D, Lakhoo M, et al. Gunshot wound of the abdomen: role of selective conservative management. *Br. J. Surg.* 1991;78:220–222
- Muckart DJ, Meumann C, Botha JB. The changing pattern of penetrating torso trauma in KwaZulu/Natal—a clinical and pathological review. *S. Afr. Med. J.* 1995;85:1172–1174
- Campbell NC, Thomson SR, Muckart DJ, et al. Review of 1198 cases of penetrating cardiac trauma. *Br. J. Surg.* 1997;84:1737–1740
- Baker LW, Thomson SR. The current status of the management of civilian injuries to the colon. *Surg. Ann.* 1991;23 Pt 1:203–223
- Stein A, Kalk F. Selective conservatism in the management of penetrating wounds of the neck. *S. Afr. J. Surg.* 1974;12:31–40
- Campbell FC, Robbs JV. Penetrating injuries of the neck: a prospective study of 108 patients. *Br. J. Surg.* 1980;67:582–586

20. Ngakane H, Muckart DJ, Luvuno FM. Penetrating visceral injuries of the neck: results of a conservative management policy. *Br. J. Surg.* 1990;77:908–910
21. Madiba TE, Muckart DJ. Penetrating injuries to the cervical oesophagus: is routine exploration mandatory?. *Ann. R. Coll. Surg. Engl.* 2003;85:162–166
22. Stein A, Schnier G. Penetrating stab wounds of the chest. *S. Afr. Med. J.* 1965;39:548–553
23. Muckart DJ, Luvuno FM, Baker LW. Penetrating injuries of the pleural cavity. *Thorax* 1984;39:789–793
24. Demetriades D, Rabinowitz B, Markides N. Indications for thoracotomy in stab injuries of the chest: a prospective study of 543 patients. *Br. J. Surg.* 1986;73:888–890
25. Hirshberg A, Thomson SR, Huizinga WK. Reliability of physical examination in penetrating chest injuries. *Injury* 1988;19:407–409
26. Thomson SR, Huizinga WK, Hirshberg A. Prospective study of the yield of physical examination compared with chest radiography in penetrating thoracic trauma. *Thorax* 1990;45:616–619
27. Hirshberg A, Thomson SR, Bade PG, et al. Pitfalls in the management of penetrating chest trauma. *Am. J. Surg.* 1989;157:372–375
28. Huizinga WK, Baker LW, Mtshali ZW. Selective management of abdominal and thoracic stab wounds with established peritoneal penetration: the eviscerated omentum. *Am. J. Surg.* 1987;153:564–568
29. Demetriades D, Rabinowitz B. Indications for operation in abdominal stab wounds. A prospective study of 651 patients. *Ann. Surg.* 1987;205:129–132
30. Whalen G, Angorn IB, Robbs JV. The selective management of penetrating wounds of the back. *J. Trauma* 1989;29:509–511
31. Muckart DJ, Thomson SR. Undetected injuries: a preventable cause of increased morbidity and mortality. *Am. J. Surg.* 1991;162:457–460
32. Madiba TE, Mokoena TR. Favourable prognosis after surgical drainage of gunshot stab or blunt trauma to the pancreas. *Br. J. Surg.* 1995;82:1236–1239
33. Madiba TE, Haffejee AA, Singh B, et al. Nutritional support in the management of external pancreatic fistulas. *S. Afr. J. Surg.* 1995;33:81–84
34. Thomson SR, Ghimenton F. Pancreaticogastrostomy for trauma: an alternative to distal pancreatectomy. *Injury* 2000;31:394–395
35. Breckon V, Thomson SR, Hadley GP. Internal drainage of pancreatic pseudocysts in children using an endoscopically-placed stent. *Pediatr. Surg. Int.* 2001;17:621–623
36. Whalen GF, Robbs JV, Baker LW, Sheik-Gafoor MH. Injuries of the pancreas and duodenum—results of a conservative approach. *S. Afr. J. Surg.* 1987;25:15–18
37. Singh B, Moodley J, Sheik-Gafoor MH. Conservative management of thoracobiliary fistula. *Ann. Thorac. Surg.* 2002;73:1088–1091
38. Angorn IB. Segmental dearterialization in penetrating renal trauma. *Br. J. Surg.* 1977;64:59–65
39. Angorn IB. A conservative approach to traumatic intrarenal arteriovenous fistulae: experience with 13 cases. *Injury* 1977;8:290–297
40. Velmahos GC, Toutouzas KG, Vassiliu P, et al. A prospective study on the safety and efficacy of angiographic embolization for pelvic and visceral injuries. *J. Trauma* 2002;53:303–308
41. Mokoena T, Abdool-Carrim AT. Haemostasis by angiographic embolisation in exsanguinating haemorrhage from facial arteries. A report of 2 cases. *S. Afr. Med. J.* 1991;80:595–597
42. Bryer JV, Nirmul D, Hadley GP, et al. Traumatic haemobilia: case reports. *S. Afr. Med. J.* 1977;52:451–453
43. Moodley J, Singh B, Lalloo S, et al. Non-operative management of haemobilia. *Br. J. Surg.* 2001;88:1073–1076
44. Naidoo NM, Corr PD, Robbs JV. Angiographic embolisation in arterial trauma. *Eur. J. Vasc. Endovasc. Surg.* 2000;19:77–81
45. du Toit DF, Leith JG, Strauss DC, et al. Endovascular management of traumatic cervicothoracic arteriovenous fistula. *Br. J. Surg.* 2003;90:1516–1521
46. Baker LW, Thomson SR, Chadwick SJ. Colon wound management and prograde colonic lavage in large bowel trauma. *Br. J. Surg.* 1990;77:872–876
47. Thomson SR, Baker A, Baker LW. Prospective audit of multiple penetrating injuries to the colon: further support for primary closure. *J. R. Coll. Surg. Edinb.* 1996;41:20–24
48. Hirshberg A, Walden R. Damage control for abdominal trauma. *Surg. Clin. North Am.* 1997;77:813–820
49. Mattox KL. Introduction, background, and future projections of damage control surgery. *Surg. Clin. North Am.* 1997;77:753–759
50. Losanoff JE, Richman BW, Jones JW. Temporary abdominal coverage and abdominal compartment syndrome. *Arch. Surg.* 2003;138:565–566
51. Suliburk JW, Ware DN, Balogh Z, et al. Vacuum-assisted wound closure achieves early fascial closure of open abdomens after severe trauma. *J. Trauma* 2003;55:1155–1160
52. Demetriades D, Velmahos G. Technology-driven triage of abdominal trauma: the emerging era of nonoperative management. *Annu. Rev. Med.* 2003;54:1–15