The Seat Belt Syndrome:

Sigmoid Colon Perforation

ROBERT M. BLUMENBERG,* CAPT., MC, USAR

From the Department of Surgery, U. S. Army Hospital, Ryukyu Islands

THE relationship of the seat belt to automobile and air safety is currently a topic of discussion amongst legislators and in the general populace. Ejection injuries, the most common cause of loss of life and limb in auto accidents, have been appreciably reduced by the use of lap-type seat belts in this country, and diagonal, over-the-shoulder type harness belts in northern Europe.[1, 2] Consequently, the common site of injury following deceleration of automotive impact has changed to the area of sudden restraint, the lower abdomen and pelvis. These injuries have been collectively designated as the *seat belt syndrome.*

In a review of the literature on intra-abdominal trauma secondary to seat belt injuries, Williams *et al.* included ten previously reported cases and four new cases of their own.[6] Subsequently, two further reports on this topic[1, 2] increase to twenty the number of cases of intra-abdominal visceral and mesenteric trauma due to the *seat belt syndrome.* The purpose of this report is to focus attention on injury to the sigmoid colon, a rare concomitant of this syndrome.

Case Report

G. S., a 25-year-old Army Sergeant, was injured on 10 June 1966. A sports car he was driving skidded on wet pavement at 35 m.p.h. and struck a pole on the driver's side throwing him laterally against the driver's door. A lap-type seat belt, anchored on the floor behind the driver's seat, was loosely secured so that a finger could be easily inserted between the lower abdomen and the belt. The left side of the patient's face struck the door and sustained a stellate laceration of the cheek; otherwise, no direct trauma was incurred. Physical examination in the emergency room of the U. S. Army Hospital, Okinawa, was unremarkable except for the facial laceration and superficial contusions of the lower abdominal wall overlying the iliac crests. Following suture of the facial laceration, the patient was discharged from the emergency room, and when seen in the surgical

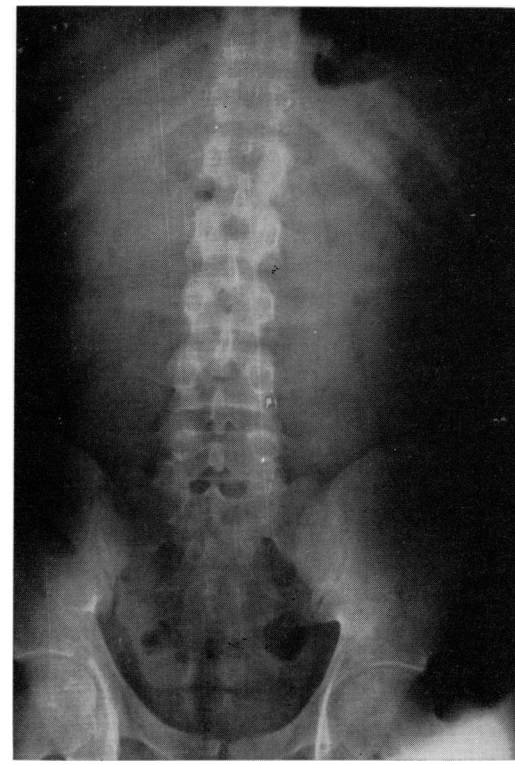

FIG. 1. Upright abdominal film not demonstrating diaphragms. Suspicious collection of gas is noted in left upper quadrant.

Submitted for publication October 17, 1966.

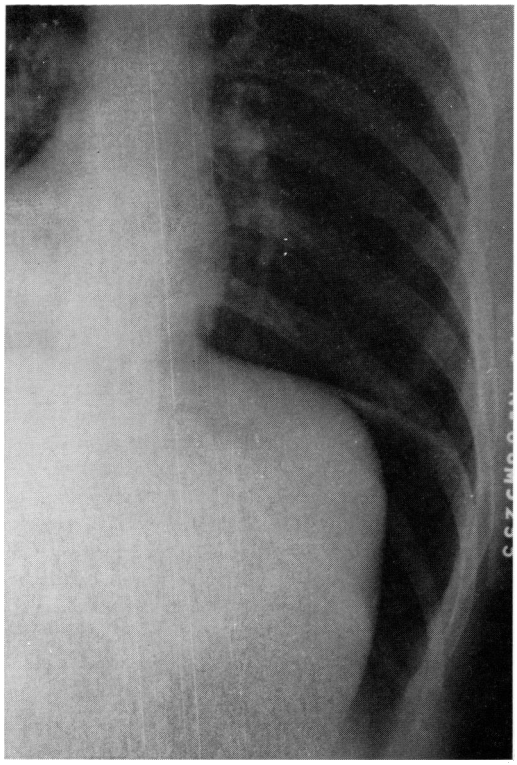

FIG. 2. Left lateral decubitus film clearly demonstrating free air in right subdiaphragmatic area.

clinic three days later was completely asymptomatic.

Bowel movements were normal until 72 hours following the accident when he had lower abdominal distention and cramps not relieved by expulsion of flatus. These were discomforting, but the patient carried out normal duties until the following afternoon when he was unable to expel flatus. At this time complaints of abdominal distress were vague, and the lower abdomen was soft with minimal spasm in the left lower quadrant. Bowel sounds were hypoactive, rectal examination was unremarkable, and the psoas and obturator signs were negative. Temperature was 99° F.; pulse, 76; Hct, 39%; Hgb, 13 Gm.%; WBC, 10,300. A supine abdominal roentgenogram showed liver, spleen, kidneys and both psoas shadows to be normal. Although upright chest film was normal, an upright abdominal film showed a suspicious collection of gas in the left upper abdomen (Fig. 1). A left lateral decubitus film was taken and showed free intraperitoneal air (Fig. 2). Immediate celiotomy disclosed a linear tear of the mesosigmoid extending to its root and avulsion of the mesentery of a four-inch segment of redundant sigmoid. Extensive induration surrounded this partially devascularized segment of bowel and there was a 2-cm. perforation on the mesenteric aspect of the sigmoid, walled off by adjacent loops of small bowel and omentum. The partially devascularized segment of sigmoid colon was resected and colostomy was performed. The patient's postoperative course was uncomplicated and secondary sigmoid anastomosis was carried out 4 weeks later on 14 July 1966. Following delayed primary closure of the colostomy wound, the patient was discharged from the hospital on 25 July 1966.

Discussion

Sudden deceleration against a relatively fixed restraining seat belt can result in mesenteric tears, avulsions and perforations most commonly of the small intestine. Additional structures injured in this manner include the retroperitoneal duodenum, pancreas, kidney, hepatic and renal veins; and intraperitoneal viscera such as liver, spleen, gravid uterus and greater omentum. Rupture of the full urinary bladder has not yet been reported as part of the *seat belt syndrome*. Avulsions and tears occur at points of fixation of otherwise mobile viscera and mesenteries; whereas, explosive visceral perforations are generally at a point where the structure overlies immobile bony framework. The redundant portion of sigmoid colon, lying in close proximity to the lumbar vertebral column, makes this segment subject to injury by both mechanisms. Yet this complication is rare in reports on the subject. Single cases of sigmoid mesenteric avulsion and hematoma formation without bowel discontinuity are reported by Williams[6] and Tollins.[4] A questionnaire sent to 19 U. S. Naval Hospitals disclosed a single case of sigmoid colon rupture due to seat belt injury.[4]

The mechanisms of injury summarized by Williams[6] involve violence applied either to the viscus directly, or to an *entrapped* hollow viscus with subsequent closed-loop rupture. Shearing forces generally result in torsion and avulsion. Bursting or explosive injury usually afflicts small bowel, but may play a role in large bowel

perforation as well. Small mesenteric vessels are torn by direct force, but mesenteric avulsion and hematoma formation with subsequent ischemia are associated with a torsion injury.

The findings in the case here presented are consistent with patterns of injury involving both mesenteric avulsion and direct bursting trauma. Lateral twisting displacement toward the driver's door with at least a finger's breadth space of *play* between the driver and the belt more than likely contributed to the torsion component of injury. Williams and Sargent[7] recorded pressure changes accompanying blunt abdominal trauma in dogs and concluded that the site of injury cannot be directly related to intraluminal pressure, the usual fixed points or to the presence of air and fluid within the intestinal lumen. Rather, compression with tearing between two opposing surfaces, such as abdominal wall and spine, is the most likely cause of injury. Therefore the redundant sigmoid colon, *flopped* over the lumbar spine, becomes vulnerable to injury in this manner.

Diagnosis is often obscured by the absence of abdominal symptoms and the paucity of physical findings on the initial postaccident examination. Seat belt contusions of the lower abdominal wall, especially about the iliac crests, should alert the examiner to possible intra-abdominal injury, especially within the lower abdomen and pelvis. Diagnostic paracentesis often confirms the general clinical impression. The importance of abdominal roentgenograms is demonstrated by the case presented. Anteroposterior supine abdominal films should be supplemented by upright and lateral decubitus views and upright chest films for free intraperitoneal air.

Devitalized or ischemic bowel should be resected with exteriorization and delayed restoration of intestinal continuity as the safest procedure. Primary anastomosis might be accomplished in selected instances when devitalization and contamination have been averted.

Summary

Intra-abdominal and pelvic visceral and mesenteric injuries incurred while wearing a seat belt have been reviewed. A case of perforation of the sigmoid colon following seat belt injury is reported. The mechanisms of intra-abdominal injury resulting from seat belts are discussed in general, and specifically in relation to the case presented.

References

1. Fish, J. and Wright, R. H.: The Seat Belt Syndrome—Does it Exist? J. Trauma, **5**:746, 1965.
2. Gerritsen, R., Forbese, A. S. and Pezzi, P. J.: Unusual Abdominal Injuries Due to Seat Belts. J. Einstein Med. Cent., **14**:63, 1966.
3. Schwimmer, S. and Wolf, R. A.: Leading Causes of Injury in Automobile Accidents. Automotive Crash Injury Research of Cornell University, New York, June, 1962.
4. Tolins, S. H.: An Unusual Injury Due to the Seat Belt. J. Trauma, **4**:397, 1964.
5. Tourin, B. and Garrett, J. W.: Safety Belt Effectiveness in Rural California Automobile Accidents. Automotive Crash Injury Research of Cornell University, New York, February, 1960.
6. Williams, J. S., Lies, B. A. and Hale, H. W., Jr.: The Automotive Safety Belt: In Saving a Life May Produce Intra-Abdominal Injuries. J. Trauma, **6**:303, 1966.
7. Williams, R. D. and Sargent, F. T.: The Mechanism of Intestinal Injury in Trauma. J. Trauma, **3**:288, 1963.