



## Mishra's Sign of Blunt Traumatic Pancreatic Injury': An Intra-Operative Telltale Sign Indicating Potential Blunt Traumatic Pancreatic Injury

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*Dear Editor*

Missed traumatic pancreatic injuries especially injury to the main pancreatic duct (MPD) is a small but significant cause for morbidity and mortality [1, 2]. During exploratory laparotomy, traumatic pancreatic injuries may pose a major challenge to the surgeon both in terms of diagnosis and management and therefore may easily be missed due to several reasons like [2-7]:

Pancreas is located in the lesser sac of the peritoneum posterior to the stomach in the retroperitoneum and therefore is not easily accessed during exploration [8].

Special maneuvers are required to adequately expose the pancreas like opening the lesser sac through gastrocolic ligament just outside the gastroepiploic vessels, extended Kocher's maneuver, division of the peritoneum along the inferior border of pancreas, left medial visceral rotation, etc. [5, 6]. These are difficult at times especially in delayed injuries due to adhesions and inflammations.

Pancreatic exploration is often complicated by the presence and extent of associated injuries [1-3]. It may be emphasized that priorities during exploratory laparotomy/ Damage Control Surgery (DCS) after trauma are hemorrhage control followed by control

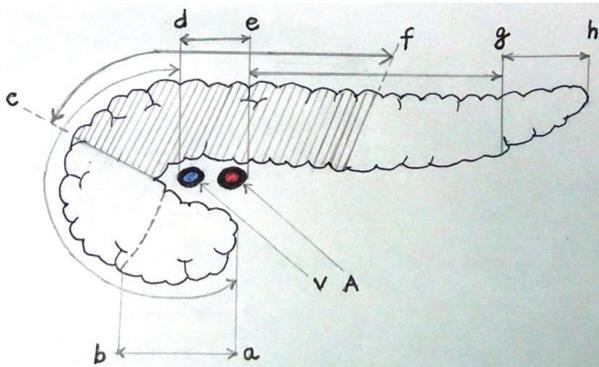
of contamination from hollow viscus perforation.

Even advanced Computed Tomography (CT) scan (which is the primary imaging modality to diagnose blunt pancreatic injuries) can easily miss significant pancreatic injuries especially if done in the early post injury phase. [6, 7, 9-11].

There may be reluctance on the part of the surgeon to adequately expose the pancreas for the above mentioned reasons. Also, attempt to adequately explore the pancreas may even cause iatrogenic complications like bleeding or hollow viscus perforations (which are very likely underreported in literature).

The intra-operative clues of pancreatic injuries include peripancreatic hematoma, peripancreatic edema, blood stained peripancreatic fluid, presence of retroperitoneal bile, omental saponification (a late sign), hematoma at the base of transverse mesocolon and central retroperitoneal hematoma [1, 2, 4, 5, 12]. Intra-operative indications of major ductal injury include direct visualization of the injury, complete transection of the pancreas, transverse laceration over 50% of the gland and central perforation and severely macerated pancreatic tissue [2, 8]. I have operated 19 cases of blunt traumatic pancreatic

injury in a level I Trauma Center in last eight years. Eighteen of these cases had pancreatic transection (complete /near total) at the neck or neck region (Figure 1). I did distal pancreatectomy (DP) with spleen preservation in 16 cases, Roux-en-Y distal pancreateojejunostomy in two cases and DP with splenectomy in one case. In ‘many’ of these cases I have observed either laceration or contusion of the

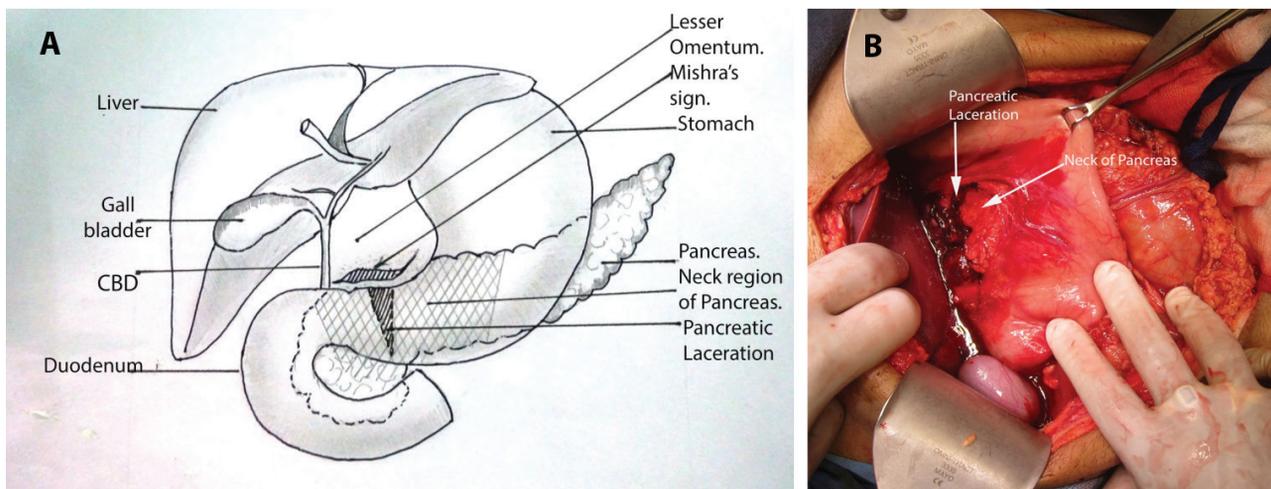


**Fig. 1.** Transverse section of the pancreas. Shaded region (c-f) denotes the ‘neck region’ (neck+distal head+ proximal body), A- superior mesenteric artery, V-superior mesenteric vein, (a-d) head, (d-e) neck, (e-g) body, (g-h) tail, (a-b) uncinata process.

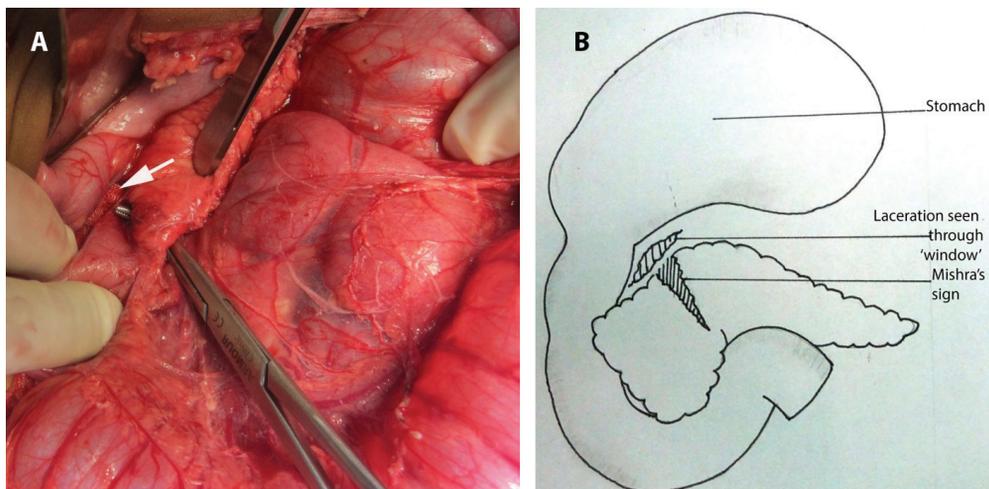
lesser omentum (hepatogastric and hepatoduodenal ligaments) adjoining the lesser curvature of the stomach around the pyloroantral region (Figure 2A). (I used the word ‘many’ and not specific figures because I don’t remember not seeing this sign in some initial cases. Also, this sign was absent in two cases, in one there was partial transection of pancreatic neck involving the lower two third of the width of the pancreas and in the other transection of the distal body). I also observed that many times even the pancreatic laceration can be seen through this ‘window’ of laceration in the lesser omentum (Figure 2B). This ‘window’ can also be visualized from inside the lesser sac once it is entered and stomach is retracted superiorly and colon inferiorly (Figures 3A and 3B).

*Possible Mechanism of the Sign*

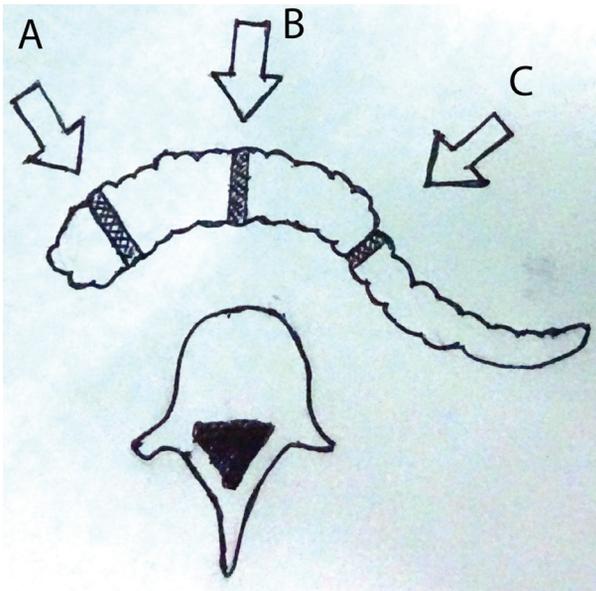
Genesis of this sign may be explained by surgical anatomy and vector of the blunt crushing force in the upper abdomen (Figure 4). The head of the pancreas lies within the concavity of the second part of duodenum and its body crosses the spine directed transversely, slight obliquely and posteriorly with tail



**Fig. 2.** Diagrammatic representation (A) and actual photograph (B) of Mishra’s sign. Note the contiguity /proximity of the sign along the upper border of neck region of pancreas.



**Fig. 3.** Actual photograph (A, arrow) and diagrammatic representation (B) of Mishra’s sign seen through the lesser sac after stomach is retracted superiorly.



**Fig. 4.** Axial section of pancreas in relation with L2 vertebral body. A,B,C represent vectors of force from anterior abdominal wall. Shaded area of pancreas represents area of injury. Forces acting from vectors A to B probably lead to Mishra's sign as the part of lesser sac along with pyloroantral region lies immediately above these areas

of pancreas placed at the hilum of spleen. Thus the 'neck region' of the pancreas (which is relatively non elastic and firm) is placed just anterior to the spine in such a way that if some blunt crushing force is applied from the anterior part of the abdomen, it gets crushed by the first or second lumbar (L1 or L2) vertebral body [1]. At the same time, the lesser omentum (a thin double layer of peritoneal fold) at the lesser curvature of the stomach, positioned just antero-superior or superior to the neck region of the pancreas (in the same vertical plane) and anterior to the body (L1) of the spine gets crushed by the same mechanism. Therefore, this laceration of lesser omentum also points to the probable site of pancreatic injury. The description of this 'sign' opens up other unanswered questions and points to the need for further research. Therefore, it is my sincere appeal to surgeons to report their findings regarding presence or absence of this sign and correlate it with significant pancreatic (neck region) injuries (i.e. along with MPD injuries) in blunt trauma. It would also be interesting to see, based on further evidence, whether meticulous pancreatic exploration (which is time consuming and technically challenging) be avoided in absence of this sign along with negative CT/MRI evidence during exploratory laparotomy for blunt upper abdominal trauma. Another pertaining topic would be to study the presence of subtle clues of this sign in CT/MRI scans.

After a thorough search of the literature and to the best of my knowledge, nowhere could I find the proper description or mention of importance of this sign. The closest indication of this sign in literature is probably mentioned in an article by Krige *et al.*

[13] in August 2005, where he mentions: "Clues suggesting the presence of a pancreatic injury include a lesser sac fluid collection, retroperitoneal bile staining or crepitus or hematoma overlying the pancreas at the base of the transverse mesocolon or visible through the gastrohepatic ligament" [4]. The reference cited for this statement was given for the article by Olah A *et al.*, [2]. But this statement couldn't be corroborated in the article by Olah A *et al.* The author (Krige) again mentions this statement in an Editorial in 2011 [13]. Also another group (KM Garg *et al.*) mentioned the same statement with the same reference in an article in 2014 [14]. I presume Krige *et al.*, [13] referred this same sign as: "...hematoma...visible through the gastrohepatic ligament". It is also highly probable that surgeons operating upon traumatic pancreas have observed this sign but mention of its significance is somehow overlooked in literature and surgical teachings.

I would like to propose to name the sign as: 'Mishra's sign of blunt traumatic pancreatic injury' or simply as 'Mishra's sign' and define it as: 'intra-operative evidence of laceration/ contusion/hematoma in the lesser omentum just around the pyloroantral region along the lesser curvature of the stomach in blunt traumatic injuries suggesting potential injury to the neck or around the neck of the pancreas'.

#### *Summary of the Significance and Implications of 'Mishra's Sign'*

Presence of this sign indicates high probability of injury to the neck region of the pancreas (specially the upper half of the width of the pancreas in case of partial transection), in the setting of blunt upper abdominal trauma during abdominal exploration. It should be noted that unlike the 'Mishra's sign', most of the other described clues for pancreatic injuries like peripancreatic hematoma etc. mandates entry into the lesser sac by opening the gastrocolic ligament.

Its presence points to the possible site of pancreatic injury/transection around the neck region of the pancreas which is just below the 'Mishra's sign' in the same vertical/ parasagittal plane. This may be immensely helpful intra-operatively as it points to the most probable site to explore the pancreas to rule out MPD injury rather than to explore the whole of the pancreas, as it is a well-known fact that intra-operative assessment of MPD injury may be difficult and may even be overlooked in presence of peripancreatic hematoma [15].

In presence of this sign, it may be strongly recommended to thoroughly explore the pancreas (especially the neck region) to rule out injury to the MPD.

Absence of this sign (along with evidence of negative CT/ MRI for pancreatic injuries) may indicate very less probability of blunt pancreatic trauma requiring surgical intervention, which may obviate the need for pancreatic exploration and avoid its disadvantages.

Absence of this sign does not necessarily rule out blunt trauma to pancreas especially to the distal end of pancreas or lower half of the width of pancreas or uncinata process. In such cases hematoma, contusion or laceration at the base of mesocolon is most expected.

It is my suggestion that during exploratory laparotomy, if this particular sign is present, there

should be a very high suspicion for traumatic pancreatic injury at the neck region and therefore pancreas should be adequately explored unless DCS is underway in which case pancreatic exploration should be deferred.

**Conflict of Interest:** None declared.

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