

Diagnostic effectively of Plain Radiography for Hallow Viscous Perforation in patients of Perforation Peritonitis admitted in surgery department of SMS Hospital Jaipur (Raj)

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Abstract—In developing world where limited availability of resources and over burden of patient imposing a limitation in adapting advanced radiological technique as a first line of investigation, plain radiography may be considered as a valuable screening tool in detecting pneumoperitoneum if it's effectively is acceptable. A validational type of observational study was conducted on 1723 patients of perforation peritonitis confirmed by laprotomy to find out the effectiveness of plain radiography in diagnosing hollow viscous perforation. All these patients were advised an upright chest and erect abdominal radiograph before going to surgery. Gas under Diaphragm (GUD) was seen and compared the findings of laprotomy to find out effectiveness of the plain radiography in diagnosing hallow viscous perforation. Positivity Rate of plain radiography either upright chest X-ray or erect abdomen in detecting pneumoperitoneum is 89.20%. So in developing world with limited resources plain radiography may be adopted as screening tool in detecting pneumoperitoneum

Key words: Diagnostic Effectiveness, Gas under Diaphragm (GUD), Laprotomy, Peritonitis, Pneumoperitonium

1. Introduction

Gastrointestinal perforations remain the most common cause of surgical pneumoperitoneum since the time immortal. Perforation said to occur when pathology has breached through all the layers of the hollow viscus with resultant escape of intraluminal content into the peritoneal cavity and peritoneal contamination. This necessitates the patient to attend the casualty usually with the features of peritonitis either localized or generalized.

It has been stated that presence of pneumoperitoneum reflects visceral perforation in 85% to 90% of all occurrence^{1,2,3} and only 50% to 70% cases of hollow viscus perforation shows presence of pneumoperitoneum at first instance on plain radiography.^{4,5,6,7} Sensitivity varied from 50% to 98%, depending upon the type of radiograph that has been captured (upright chest, erect abdomen, left lateral decubitus, supine abdomen film) and additional postural manoeuvre taken into account to increase the sensitivity of detecting pneumoperitoneum.^{5,8,9,10,11}

With the advent of newer diagnostic modality like USG and CT scan, value of plain radiograph is overshadowed to detect pneumoperitoneum in current scenario. But in context of developing country with the limited resources, plain radiography may be accepted as 1st line of diagnosing tool in perforation of hallow viscous if it has acceptable sensitivity and specificity.

This present study was to find out the effectiveness of plain radiography in diagnosing hollow viscous perforation. So that plain radiography may be continued as a standard part of preoperative assessment of patient those suspicious of perforation.

2. Methods

A validation type of observational study was carried out on patient complaining of abdominal pain with or without abdominal distension or vomiting were admitted between 1st January 2009 and 31st June 2011 to general surgery department of Swai Man Singh Hospital Jaipur were prospectively analyzed. All these patients were advised to have an upright chest and erect abdominal radiograph. If radiographs suggestive of or came out with gas under diaphragm(GUD) patient admitted or transferred to general surgery department immediately for further line of management. When no abnormality was appreciable on radiographs but patient general condition and clinical finding necessitate further diagnostic workup were also taken into consideration for close observation and further workup.

Inclusion criteria:

1. Patient age >12 years (adolescent and later on groups) suspicious of hollow viscus perforation as a result of underlying disease process
2. Patient of isolated blunt trauma abdomen (BTA) or BTA as a part of multiple injuries
3. Endoscopic procedure related perforation (UGE, LGE, ERCP etc.)
4. Patient in those nonsurgical pneumoperitoneum has been excluded

Exclusion criteria: (irrespective of whether pneumoperitoneum was present or not)

1. Patient age \leq 12 years
2. Patient of gunshot injury or penetrating injury to the abdomen
3. Patients who had undergone laprotomy or laparoscopic procedure in the previous 30 days period
4. Patient who had intraoperative iatrogenic perforation
5. Patient of benign pneumoperitoneum
6. Female who encountered genital injury either during diagnostic or therapeutic procedure (MTP, HSG, HSS etc.)

All patients were assessed and evaluated and decision for operative procedure was taken. **Only those patients were included in the study who had confirmed hollow viscus perforation at the time of exploratory laprotomy.** Patient in whom no perforation was found on exploratory laparotomy irrespective of either pneumoperitoneum was present or not on radiography were also excluded from study at the second stage of exclusion.

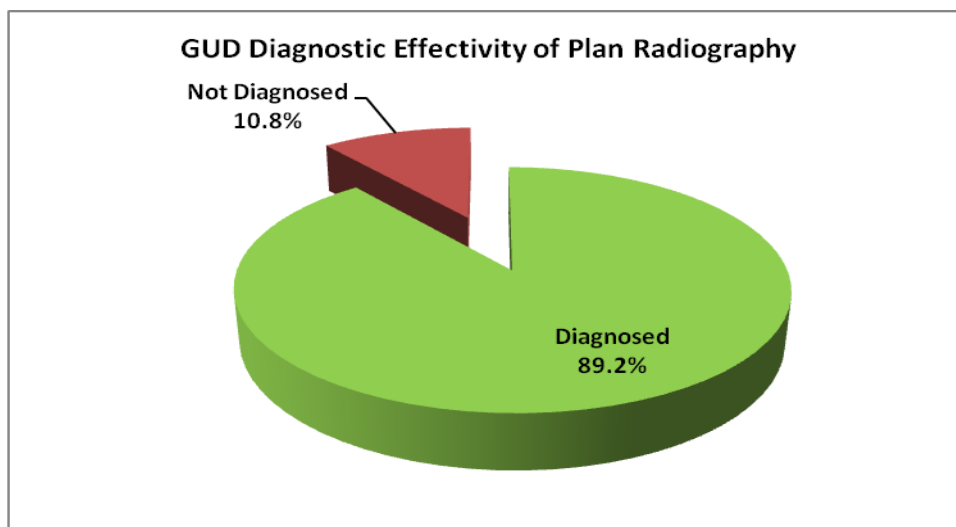
Desired information about the finally selected cases were collected and entered in Microsoft Word Office Excel 2007. Data thus collected were classified and analysed with the help of Microsoft Word Office Excel 2007 and Primer Statistical Software version 6.

3. Results

Out of A total of 1723 patient were incorporated for analysis, 286 (16.60%) were female and 1437 (83.40%) were male having M:F ratio 5.7. Mean age of these study subjects was observed 39.19 years with SD 17.08years.

Out of 1723 patients of documented perforation on intra-operative finding, 1537 patients (89.20%) showed pneumoperitoneum on pre operative radiography either upright chest or erect abdomen or both. So, overall Positivity Rate of plain radiography in detecting GUD was observed 89.20%. (Figure 1)

Figure 1



Most common site of perforation was stomach and duodenum which constituted about half of total patients i.e. 860 (49.91%) of total patient (Table 1). Positivity rate for plain radiography in detecting pneumoperitoneum at this site (stomach & duodenal perforation) found to be 94.19% (810 out of 860 positive for GUD).

Second most common site of perforation was ileum which constituted 775 (44.98%) of total perforation (Table 1). Positivity rate for plain radiography in detecting ileal perforation was found to be 91.35% (708 out of 775 showed GUD) (Table 1).

Table 1
Association of GUD with Site of Perforation

S.NO.	Site of Perforation	GUD		Total NO. (%)	GUD Positivity Rate
		Absent	Present		
1	Appendix	60	5	65 (3.77)	7.69
2	Colonic	6	4	10 (0.58)	40.00
3	Ileal	67	708	775 (44.98)	91.35
4	Jejunal	3	10	13 (0.75)	76.92
5	Stomach & Duodenum	50	810	860 (49.91)	94.19
6	Grand Total	186	1537	1723 (100)	89.20

Chi-square test =501.54 at DF 4, P<0.001, LS=S

Other sites of perforation were appendix (in 65 patients i.e.3.77%), jejunum (in 13 patients i.e.0.75%) and only in 10 patients (0.58%) the perforation was found in colon. Positivity rate for plain radiography in detecting appendicular, jejuna and colonic perforation was observed 7.69%, 76.92% and 40% respectively. (Table 1)

This difference in Positivity rate for plain radiography in detecting sites of perforation is significant ($P<0.001$). It was observed highest in detecting stomach and duodenal perforation (94.19 %) and lowest in appendicular perforation (7.69 %). Positivity rate is more than 90% in detecting ileal, stomach and duodenal perforation so it can be used as effective diagnostic tool in these cases. In detecting jejuna perforation also it is quite effective (positivity rate 76.92%) diagnostic tool but in case of detecting appendicular and colonic perforation its role is doubtful. (Table 1)

Inflammatory was the main mode of perforation observed in 1651 (95.82%) patients. Positivity rate for plain radiography in detecting in these cases was found to be 89.95% (1485 out of 1651 positive for GUD). (Table 2)

Other modes of perforation were blunt trauma abdomen (BTA), iatrogenic and malignancy. In one case mode was not able to be found out. Positivity rate for plain radiography in detecting BTA, iatrogenic and malignancy mode of perforation was observed 74.6%, 25% and 75% respectively. (Table 2)

This difference in Positivity rate for plain radiography in detecting modes of perforation is also observed significantly ($P < 0.001$). It was observed highest in detecting inflammatory mode of duodenal perforation (89.95 %) and lowest in iatrogenic mode of perforation (25 %). Positivity rate is 89% in detecting inflammatory mode of perforation so it can be used as effective diagnostic tool in that. In detecting BTA and malignancy modes of perforation also it is quite effective (positivity rate 74.62% and 75% respectively) diagnostic tool but in case of detecting iatrogenic mode of perforation its role is doubtful. (Table 2)

Table 2
Association of GUD with Mode of Perforation

S.NO.	Mode of Perforation	GUD		Total No. (%)	GUD Positivity Rate
		Absent	Present		
1	BTA	16	47	63 (3.66)	74.6
2	Iatrogenic	3	1	4 (0.23)	25
3	Inflammatory	166	1485	1651 (95.82)	89.95
4	Malignant	1	3	4 (0.23)	75
5	Unknown		1	1 (0.06)	100
6	Grand Total	186	1537	1723 (100)	89.2

Chi-square test =35.88754 at DF 4, $P < 0.001$, LS=S

Difference in Positivity rate for plain radiography in detecting perforation was found just significant as per the age ($P = 0.013$) but it was not found significant at all as per the sex ($P = 0.62$). Positivity rate varies from 86.74 % to 95.94 % and increases as per the age. (Table 3 & 4)

Table 3
Association of GUD with Age of the Patients

S.NO.	Age Groups	GUD		Total No. (%)	GUD Positivity Rate
		Absent	Present		
1	>12-30yr	90	599	689 (39.99)	86.94
2	31-50yr	66	537	603 (35)	89.05
3	51-70yr	28	356	384 (22.29)	92.71
4	>70yr	2	45	47 (2.73)	95.74
5	Grand Total	186	1537	1723 (100)	89.20

Chi-square test =10.674 at DF 3, $P = 0.017$, LS=S

Table 4
Association of GUD with Sex of Patients

S.NO.	Sex	GUD		Total No. (%)	GUD Positivity Rate
		Absent	Present		
1	Female	28	258	286 (16.6)	90.21
2	Male	158	1279	1437 (83.4)	89.00
3	Grand Total	186	1537	1723 (100)	89.20

Chi-square test =0.245 at DF 1, P=0.620, LS=NS

4. Discussion

This present study observed that Overall Positivity Rate of plain radiography in detecting GUD was observed 89.20%. Other choice is USG which has shown sensitivity of 92% (12) and 85% (13) in detecting pneumoperitoneum in patients of acute abdomen and victim of BTA. But the major drawback of with both studies was, results were totally dependent on experienced operator observations. In the first study USG done by a blinded ultrasonographer who was either staff surgeon or staff emergency physician. While in second study examination were performed by gastroenterologic general surgeon experienced in gastroenterologic surgery, other general surgery or trauma surgery. Here it can be observed that plain radiography is well comparable (89% v/s 85% or 92%) with no significant difference ($P>0.05$). So it was found significantly satisfactory in detecting hallow viscous perforation.

Absence of pneumoperitoneum, in some cases of hollow viscus perforation cover by peritoneum, can be a result of insufficient amount of air leak to be detected on roentgenogram, delayed presentation to the hospital during which escaped gas may get absorb [as post surgical pneumoperitoneum will resolve within 2 days in 2/3 of cases and within 5 days in 97% cases when assessed by serial abdominal radiography (14)], obliteration of sub diaphragmatic space by a pathological process (15), adhesion, absence of intraluminal gas at the site of perforation, filling of lumen of perforated viscus by fluid, the plugging of the perforation by food or redundant mucosa, sealing of the perforation by omentum or peritoneum before the escape of intra luminal gas in amount which could be demonstrated by radiological method (8).

Another choice is to go with CT scan to increase the sensitivity to detect pneumoperitoneum that will neither be cost effective nor safe (unnecessary 35 times extra radiation exposure). This will also lead to more dependency on diagnostic modalities and loss of clinical acumens.

CONCLUSIONS

In developing world where limited availability of resources and over burden of patient imposing a limitation in adapting advanced radiological technique as a first line of investigation, plain radiography either upright chest X-ray or erect abdomen should be considered as a valuable screening tool in detecting pneumoperitoneum as a first line with positivity rate of 89.20% in detecting hallow viscous perforation which will be more cost effective, better interpretation and less operator dependent.

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