



**A CASE REPORT OF A PNEUMATIC COLON INJURY FOLLOWING HIGH PRESSURE BLOW GUN DUST CLEANER SPRAY TO PERINEUM**

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**KEYWORDS :**

**INTRODUCTION**

A pneumatic tool such as blow gun dust cleaner (BGDC) is a tool driven by a gas, usually compressed air supplied through an air compressor. It is popular and readily available in the do it yourself market and common in small family industrial and manufacturing settings in Taiwan. The first case of pneumatic rupture of the colon was reported by Stone [1]. Industrial accident and perineal blasting with compressed air had been commonly reported in adult and results in colon injury either with or without perforation. We present a case of 15 year old boy with tension pneumoperitoneum and transverse colon perforation associated with multiple site non perforated colon injury secondary to spraying of the perineum using high pressure BGDC.

**CASE REPORT**

(A): Blow gun dust cleaner  
(B):Abdomen X ray B

AA 15 year old male presented at civil hospital, Ahmedabad at 3:24 am on 19 th July 2019 with alleged history of assault by spraying of high pressure and high flow pneumatic tool over perineal region by his co-worker at 1:00 am on 19 July 2019 at Lama, Devraj mill, ahmedabad. On arrival he had complaint of generalised abdominal distension with generalised abdominal pain,multiple gastric vomiting and difficulty in breathing.Vitals were pulse:108/min,Blood pressure:136/70 mmHg,Respiratory rate: 22/min.On physical examination abdomen was distended with generalized tenderness, guarding,hypoactive bowel sound. Perianal area did not showed any sign of trauma.

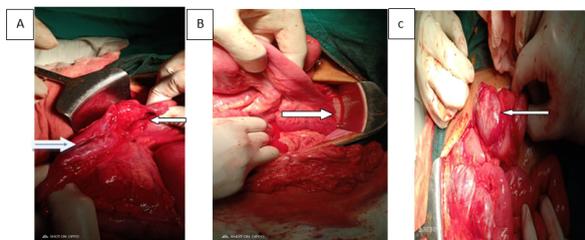


(A) Blow Gun Dust Cleaner



(B) Abdomen x ray

Abdomen x ray standing was suggestive of free gas under both the dome of diaphragm and multiple dilated bowel loops.Chest x ray standing was suggestive of free gas under both the dome of diaphragm .His laboratory workup showed a hemoglobin 14.5gm/dL, hematocrit 34.9%, white blood cell count 13.8×103/cmm platelet count 429×103/cmm.



**INTRAOPERATIVE FINDINGS**

Figure [A]:perforation of transverse colon and serosal tear,[B]:serosal tear in caecum [C]:serosal tear in sigmoid colon

Emergent exploratory laparotomy was done. On opening the abdomen, significant foul smelling air whistled out of the abdominal cavity. Localized 30cc faecal collection present in splenic fossa and left paracolic gutter.Multiple serosal tear of approx 3-5 cm in sigmoid colon, approx 30cm in transverse colon and 5cm serosal tear in caecum. 5\*3 cm perforation at transverse colon at junction of right 2/3 and left 1/3 at antemesenteric border. The diaphragm, liver, spleen, and pancreas were normal. Primary repair of transverse colon perforation done using silk 2-0 in two layer-one full thickness interrupted and 2<sup>nd</sup> seromuscular interrupted. Primary repair

of serosal tear over sigmoid colon, transverse colon and caecum done using silk 2-0 multiple interrupted. Diverting loop ileostomy was done 25cm proximal to IC junction. Patient was kept NBM for 4 days and was kept on total parenteral nutrition for the period of NBM. On POD-5 sips started with RT (ryles tube) in situ. RT removed on POD-7 and was started on liquid diet for two days then soft diet started on POD-9. Stomy functioning started on POD-5. Patient was discharged in stable condition 21 days later. Ileostomy closure was done 6 week later after confirming the patency of distal colon by distal loopogram. Patient was discharged in stable condition with tolerating all orally and passing stool regularly.

## DISCUSSION

External pneumatic insufflation of the colon through the anus depends on the air pressure, air flow velocity, anal resting pressure and the distance between the source and anus [1,2]. Under normal condition, normal resting anal pressure can prevent the insufflation of the colon from a direct external source with low air pressure. Duthie and Wattes study showed that the mean anal pressure in normal adult subject was  $0.87 \pm 0.005$  kg/cm<sup>2</sup> ( $12.4 \pm 0.711$  psi/640 $\pm$ 50mmHg) with a range 0.06–0.109 kg/cm<sup>2</sup> (0.85–1.55 psi/44–80mmHg). Andrew have postulated that air at 3.5–8.8 kg/cm<sup>2</sup> (50–125 psi/2585–6464mmHg) forms a column which acts like a solid body, forcing to open the anal sphincter [3]. BGDC at 8.2 kg/cm<sup>2</sup> (116.6 psi/6031mmHg) pressure, as in our case, can produce an air thrust of tenfold greater than the resting anal pressure and overcome the anal sphincter pressure, resulting in sudden inflation of the colon. The bowel wall is elastic, distensible and tolerates certain amount pressure. The mucosa is the most elastic and the serosa and the muscularis, the least. The intraluminal pressure required to result in colon perforation has been estimated through colonoscopic studies and was found to be greater than 0.109 kg/cm<sup>2</sup> (1.547 psi/80mmHg) [4]. Flow represents the quantity of compressed air that passes through a section over a unit of time and varies depending on the diameter of the hose and air pressure. The air flow of gun cleaner is estimated to be 141 L/min (5 cfm), which is 100 fold greater than the safe level airflow of 1.46 L/m (at 80mmHg intraluminal pressure) during colonoscopic examination [4] and hydrostatic pressure or air flow pressure of 0.16 kg/cm<sup>2</sup> (2.32 psi/120mmHg) during barium [5], saline [6], and air reduction [7] of intussusception, which protects patients from colonic barotrauma. During gradual insufflation of colon or in large bowel obstruction distal to the caecum, the caecum is the segment most prone to distention injury which is explain by the Law of Laplace [8]. The caecum has the largest diameter and requires the least amount of pressure to distend [9]. An important corollary to Laplace's theorem is that the degree of angulations (sharpness of cylinder curvature) is more important in determining wall tension than its internal volume [5]. The anatomy of the distal colon with the firm lateral support of the rectum makes the first part of the colon to be struck by a column of pressure from external source and the bending of the sigmoid [10] pose the recto sigmoid to rupture in pressure related colon barotraumas. During rapid air distention, inability to produce a total obstruction by the bending of sigmoid and high pressure allows the flow of air proximally to the next anatomical bending such as splenic flexure and hepatic flexure and ileocaecal valve resulting in a stepwise closed loop obstruction, resulting in other site of the bowel to be injure and perforate. comparison of different section of the colon shows that the rectum supports the greatest pressure and the sigmoid, transverse colon, caecum in decreasing strength. The pathologic lesions following pneumatic insufflation depends on the resultant intraluminal pressure and includes serosal hemorrhage, lacerations of the serosa and muscular coat with bulging of the mucous membrane, or complete rupture of the bowel through the serosa, muscular coat, and mucous membrane as in our case. Management of pneumatic colon injury include rectal tube decompression, intraoperative decompression of bowel

in the presence of distended bowel, resection of severely injured segment of colon and repair of perforation with proximal diverting colostomy or enterostomy, when the integrity of the bowel is in doubt. Careful observation following surgery is often necessary since fullthickness perforation of the colon may have delayed presentation. Closure of ostomy can be perform as early as 2–3 weeks of following creation without significance increase in complications compared to late closure and depends on whether patient had recovered from his initial injuries, which is assess with barium enema or sigmoidoscopic examination.

## CONCLUSION

Patient with tension pneumoperitoneum associated with multiple site colon injury and perforation, the importance of history is emphasized. Ileostomy should be done to give rest to the extensively traumatised large bowel. After stomy closure gradual graded oral feed should be started.

## Conflicts of interest

All authors state no conflicts of interest.

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