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PERIOPERATIVE BOWEL SOUND DYNAMICS AS A MARKER OF GASTROINTESTINAL RECOVERY IN PATIENTS UNDERGOING GENERAL ANESTHESIA: AN OBSERVATIONAL STUDY

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Abstract

Introduction: Bowel sounds, also known as abdominal sounds, are produced by the movement of the intestines as food passes through them. These sounds are typically normal and indicate proper gastrointestinal function, assessed by healthcare providers using a stethoscope through a process known as auscultation. However, abnormal bowel sounds can suggest underlying issues, such as ileus, which is characterized by reduced intestinal activity and can lead to complications if not addressed. General anesthesia is known to inhibit gastrointestinal function, necessitating careful postoperative monitoring to ensure the timely resumption of bowel activity.

Materials and Methods: This was a prospective, randomized observational study conducted at Saveetha Medical College & Hospital between September 2023 and August 2024. The study included 50 patients aged 18 years and above, undergoing elective surgery under general anesthesia, and classified as ASA I & II. Patients undergoing abdominal or emergency surgeries were excluded. Bowel sounds were recorded at three intervals: preoperatively, immediately postoperatively, and 3 hours postoperatively using a stethoscope. The primary outcome measured was the change in bowel sounds post-anesthesia.

Results: The study participants had a mean age of 37.25 years (SD 10.76), with 44% males and 56% females. The mean BMI was 23 (SD 12), and the average duration of surgery was 2.85 hours (SD 1.42). Preoperatively, 10% of patients had a bowel sound frequency of less than 8, but this decreased to zero 6 hours postoperatively. The frequency of 11-14 increased from 56% preoperatively to 68% postoperatively, with a significant p-value of 0.036. Among patients with a BMI greater than 25 and surgery duration exceeding 3 hours, there was a significant increase in bowel sound frequencies at 3 and 6 hours postoperatively, with p-values of 0.024 and 0.001, respectively.

Conclusion: This study demonstrated that bowel sound monitoring is a vital component of postoperative care in patients undergoing general anesthesia. The gradual return of bowel sounds post-surgery, particularly in patients with higher BMI and longer surgeries, indicates the resumption of gastrointestinal motility and can guide the timing of nutritional intake and other recovery protocols. Further research is recommended to refine these monitoring techniques for enhanced patient outcomes.

Keywords: Bowel sounds, General anesthesia, Postoperative care, Gastrointestinal recovery, BMI, Surgery duration.

INTRODUCTION

Abdominal sounds, also known as bowel sounds, are produced by the movement of the intestines as food passes through them. The intestines are hollow, which causes these sounds to resonate within the abdomen, similar to

the echoes heard from water flowing through pipes. Typically, these bowel sounds are normal and indicate that the gastrointestinal tract is functioning properly. Healthcare providers often assess these sounds by using a stethoscope to listen to the abdomen, a process known as auscultation. While most bowel sounds are harmless, abnormal sounds can sometimes suggest underlying issues (1).

One such condition is ileus, characterized by a lack of intestinal activity. Ileus can result from various medical conditions and can lead to the accumulation of gas, fluids, and intestinal contents, potentiallycausingthebowelwalltorupture.Insuchcases,ahealthcareprovidermaynotdetect any bowel sounds during auscultation. Hypoactive bowel sounds refer to a decrease in the volume, tone, or frequency of the sounds, indicating slowed intestinal activity. These sounds are typically normal during sleep or shortly after the administration of certain medications or abdominal surgery. Conversely, decreased or absent bowel sounds are often associated with constipation (2).

On the other hand, hyperactive bowel sounds, which can sometimes be audible without a stethoscope, suggest increased intestinal activity. This may occur in instances of diarrhea or after eating. The evaluation of abdominal sounds is always conducted alongside other symptoms, such as gas, nausea, the presence or absence of bowel movements, and vomiting (3).

If bowel sounds are either hypoactive or hyperactive and accompanied by other abnormal symptoms, further follow-up with a healthcare provider is advised. For example, the absence of bowel sounds following a period of hyperactivity might indicate a bowel rupture or strangulation, which can lead to necrosis of the bowel tissue. Additionally, very high-pitched bowel sounds may signal the early stages of bowel obstruction (4).

While most abdominal sounds are related to normal digestion and are generally not a cause for concern, various conditions can lead to abnormal bowel sounds. Some serious conditions associated with hyperactive, hypoactive, or absent bowel sounds include blocked blood vessels that impair intestinal blood flow, such as in mesenteric artery occlusion caused by blood clots. Mechanical bowel obstructions, which can result from hernias, tumors, adhesions, or similar conditions, can also leadto abnormal sounds. Paralytic ileus, a condition where the nerves to the intestines are impaired, can also reduce bowel sounds. Other causes of hypoactive bowel sounds include certain medicationsthat slow intestinal movement, such as opioids, anticholinergics, and phenothiazines, as well as factors like general anesthesia, abdominal radiation, spinal anesthesia, and surgery. Conversely, conditions associated with hyperactive bowel sounds include Crohn's disease, diarrhea, food allergies, gastrointestinal bleeding, infectious enteritis, and ulcerative colitis (5,6).

General anesthesia is known to inhibit gastrointestinal function, making it necessary to delay postoperative feeding until gastrointestinal activity gradually resumes. Currently, there is no objective or practical method to evaluate postoperative gastrointestinal recovery, making the timing for resuming oral intake somewhat arbitrary. However, it is crucial to ensure early nutritional intake for patients undergoing general anesthesia to promote optimal postoperative recovery. Therefore, assessing gastrointestinal function after general anesthesia is important in determining the appropriate time to resume feeding, which has significant clinical implications (7).

Aim

The aim of this study is to determine the Changes in Bowel sounds in patients undergoing General Anesthesia

Objectives

The primary objective is to assess the changes in the bowel sounds in patients who are undergoing surgery under general anesthesia and to restart feeds earliest postoperatively.

The secondary objective is to compare the postoperative bowel sounds with preoperative parameters.

MATERIALS AND METHODS

This study was a prospective, randomized observational investigation conducted in the Department of Operation Theater and Anesthesia at Saveetha Medical College & Hospital.

Materials Used: A stethoscope was the primary tool used in the study.

OutcomeMeasure:Theprimaryoutcomemeasuredwasthechangeinbowelsoundsinpatients undergoing general anesthesia.

Study Design: The study was designed as a randomized observational study. Study

Period: The study was conducted from September 2023 to August 2024.

Study Location: The research was carried out at Saveetha Medical College Hospital. Sample size:

The study included 50 patients.

Selection Criteria:

Inclusion Criteria:

- Patients aged 18 years and above.
- Patients undergoing elective surgery under general anesthesia.
- Patients classified as ASA I & II.
- Patients undergoing non-bowel surgeries.

- Patients with an American Society of Anesthesiologists (ASA) physical status classification of I-II.

Exclusion Criteria:

- Elderly patients over 60 years of age.
- Patients undergoing abdominal surgeries.
- Patients with inadequate NPO status.
- Patients undergoing emergency surgeries.
- Patients undergoing bowel surgeries.

Study Procedure: Intubation was performed by experienced anesthesiologists using a standard endotracheal tube (ETT) with a high-volume, low-pressure cuff. Baseline cuff pressure was measured with a calibrated cuff manometer to ensure consistency across all procedures. The study involved randomly selecting 50 inpatients, and three sets of 5-minute continuous bowel sound (BS) data were collected for each patient: before the operation (Pre-op), immediately after the operation (Post-op), and three hours post-operation (3 h-Post-op).

Preparation:

A stethoscope with a diaphragm, which is more suitable for detecting high-pitched sounds such as bowel sounds, was used. Patients were positioned lying comfortably on their back or side in a quiet room to minimize external noise interference.

Auscultation Locations:

- Right Lower Quadrant (RLQ): Near the right iliac fossa, where the ileocecal valve is located.
- Left Lower Quadrant (LLQ): Near the left iliac fossa.
- All Quadrants: The stethoscope was moved to listen in all four quadrants of the abdomen(RLQ, RUQ, LUQ, LLQ).

Auscultation Technique: The stethoscope diaphragm was warmed by placing it on the hand or clothing briefly to improve sound transmission. Light pressure was applied to the patient's skin to avoid mufling the sounds. Patients were instructed to relax and breathe normally while the researcher listened, focusing on distinguishing the different types of bowel sounds.

Types of Bowel Sounds Recorded:

- NormalBowelSounds:Theseweretypicallyhigh-pitchedandgurgling,heardevery5-15 seconds.
- HyperactiveBowelSounds:Increasedfrequencyandloudness,oftenassociatedwith diarrhea or early mechanical bowel obstruction.
- Hypoactive or Absent Bowel Sounds: Reduced or no bowel sounds, indicating possible bowel obstruction, peritonitis, or paralytic ileus.

Interpretation:

- Frequency: Normally, bowel sounds occur 5-30 times per minute.
- Intensity: Normal bowel sounds are soft and relatively quiet. Increased loudness or intensity might indicate underlying pathology.
- Pattern: The regularity or irregularity of bowel sounds was analyzed to provide clues about the underlying condition.

RESULTS

The baseline characteristics of the study participants, as shown in Table 1, indicate that the average age was 37.25 years with a standard deviation (SD) of 10.76 years. The study included 50 participants, of whom 44% were male (n=22) and 56% were female (n=28). The average height and weight of the participants were 164 cm (SD 13) and 62 kg (SD 27), respectively, resulting in a mean BMI of 23 (SD 12). The average duration of surgery was 2.85 hours with an SD of 1.42 hours.

Table1: Baseline Characteristics

Variable	Total no of participants n=50 (%)
Age in years (Mean (SD))	37.25 (10.76)
Male	22 (44%)
Female	28 (56%)
Height (Mean (SD))	164 (13)
Weight (Mean (SD))	62 (27)
BMI (Mean (SD))	23 (12)
Duration of surgery in hours (Mean (SD))	2.85 (1.42)

Table 2 compares the preoperative and 6-hour postoperative bowel sounds among the study participants. Before surgery, 10% of the patients had a bowel sound frequency of less than 8, but none of the patients fell into this category 6 hours after surgery. Additionally, 34% of the participants had a preoperative frequency of 8-10, slightly decreasing to 32% postoperatively. In contrast, the frequencyof11-14 increased from 56% preoperatively to 68%6 hours after surgery. Thep-valueof 0.036 in dicates a statistically significant difference in bowel sound frequencies between the preoperative and postoperative periods.

Table 2: Comparisonofpreop and 6 hrs post-op bowel sounds in the study participants

Frequency	No. of Patients Pre- op	Percentage	No. of Patients 6 hrs Post op	Percentage	p-value
< 8	5	10%	-	-	**0.036**
8 to 10	17	34%	16	32%	
11 to 14	28	56%	34	68%	

Figure 1 illustrates the distribution of bowel sound frequencies in the immediate postoperative period among the study participants. The chart shows that 18% of the patients (n=9) exhibited a bowel sound frequency of 0 to 1 in the immediate postoperative period. In contrast, a significantly larger portion, 82% of the patients (n=41), had a bowel sound frequency of 2 to 4 during the same period. This distribution suggests that the majority of patients experienced more active bowel sounds (frequency of 2 to 4) shortly after surgery, while a smaller group exhibited minimal bowel sounds (frequency of 0 to 1).

Figure 1:Frequencyof bowel sound in theimmediate post op period

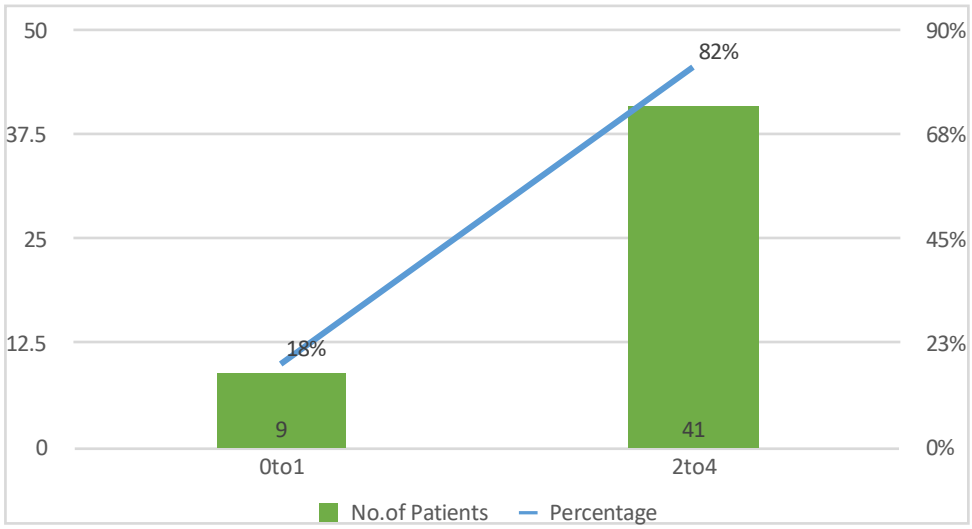

Figure 2 illustrates the distribution of bowel sound frequencies among patients 3 hours after surgery. The data reveals a clear progression in bowel activity as the majority of patients exhibited higher frequencies of bowel sounds as time progressed. Specifically, 20% of the patients had a bowel sound frequency of less than 6, while 24% had frequencies between 6 to 8. Notably, the largest group, comprising 56% of the patients, demonstrated bowel sound frequencies in the range of 9 to 11.

Figure 2: Frequencyof bowel sound in 3 hours post op period

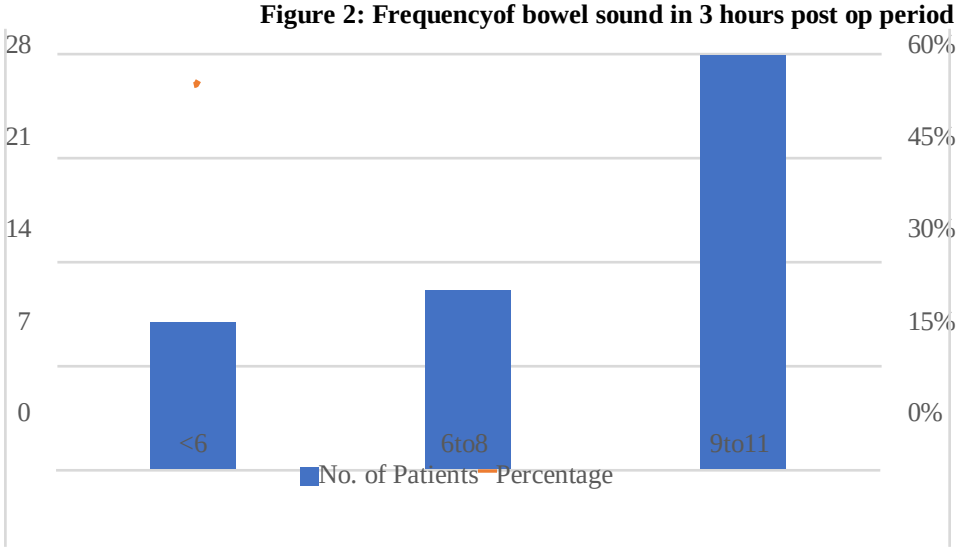

Table 3 further examines postoperative bowel sounds in a subset of 9 patients with a BMI greater than 25 and a surgery duration of more than 3 hours. Immediately after surgery, the bowel sound frequency ranged from 0-3. At 3 hours post-surgery, the frequency increased to a range of 4-9, with a significant p-value of 0.024. By 6 hours post-surgery, the frequency range further increased to 8-13, with a highly significant p-value of 0.001, indicating a clear trend of increasing bowel sound activity over time in this specific patient group.

Table 3: Post-operative bowel Sounds in 9 Patientswith BMI >25 and SurgeryDuration>3 Hours

Time After Surgery	Frequency Range	P-Value
0 Hours	**0-3**	**-**
3 Hours	**4-9**	**0.024**
6 Hours	**8-13**	**0.001**

DISCUSSION

The results of this study provide significant insights into the changes in bowel sound frequencies among patients undergoing surgery, with a focus on the postoperative period. The baseline characteristics of the study participants reveal a relatively young population, withanaverage age of 37.25 years, and a balanced gender distribution of 44% males and 56% females. The participants' mean BMI was 23, and the average duration of surgery was approximately 2.85 hours.

A key finding of this study is the marked change in bowel sound frequencies from the preoperative period to 6 hours postoperatively. Initially, 10% of the patients had a bowel sound frequency of less than 8, but this category was completely absent 6 hours after surgery. This suggests a significant increase in bowel activity post-surgery, which is indicative of the resumption of gastrointestinal motility. This observation is consistent with the findings of Luckey et al., who reported that the return of bowel sounds is an early and reliable indicator of gastrointestinal recovery following surgery (8).

The most pronounced change was observed in the number of patients with bowel sound frequencies in the 11-14 range, which increased from 56% preoperatively to 68% postoperatively. The significant p-value of 0.036 underscores the importance of monitoring bowel sounds as a critical marker for postoperative recovery. Boulangeretal.highlightedsimilarfindings,notingthatearlydetectionof bowel sounds correlates strongly with successful postoperative outcomes and the early resumption of oral intake (9).

The distribution of bowel sound frequencies immediately postoperatively, as shown in Figure 1, supports the idea that bowel activity generally resumes soon after surgery. In this study, 82% of patients exhibited bowel sound frequencies in the range of 2 to 4, indicating moderate activity. Sasse et al. found similar results,

emphasizing that bowel sounds typically return within a few hours post- surgery, barring any complications (10).

Further analysis in Figure 2 of bowel sound frequencies 3 hours after surgery reveals a clear progression in gastrointestinal activity, with the majority of patients (56%) demonstrating higher frequencies (9-11). This progression suggests that bowel motility continues to improve as time progresses postoperatively. Moore et al. also observed that early recovery of bowel sounds is associated with a reduced incidence of complications and a shorter hospital stay, underscoring the importance of early bowel sound monitoring (11).

Table 3 provides additional insights into a specific subset of patients with a BMI greater than 25 and a surgery duration exceeding 3 hours. The significant increase in bowel sound frequencies at 3 and 6 hours postoperatively, as evidenced by p-values of 0.024 and 0.001 respectively, indicates that even in patients with higher BMI and longer surgery durations, bowel sounds tend to normalize as the postoperative period advances. Lobo et al. similarly reported that patients with increased BMI and longer surgical times often require close monitoring, as bowel sound recovery can be a critical indicator of overall gastrointestinal function and postoperative recovery (12).

The findings from this study are in line with existing literature, reinforcing the importance of bowel sound monitoring as a simple yet effective tool in assessing postoperative recovery. The significant changes in bowel sound frequencies observed, particularly in the early postoperative period, emphasize the relevance of this practice. These results suggest that further research should focus on refining postoperative care protocols, particularly for patients with higher risk factors such as increased BMI or prolonged surgery durations.

CONCLUSION

This study successfully achieved its aim of determining the changes in bowel sounds in patients undergoing general anesthesia. The findings demonstrate a significant progression in bowel sound activity from the immediate postoperative period to 6 hours post-surgery. Initially, a portion of patients exhibited minimal bowel sounds, but as time progressed, there was a marked increase in bowel sound frequencies, indicating the gradual return of gastrointestinal motility. These changes were particularly notable in patients with a higher BMI and longer surgery durations, where a clear trend of increasing bowel sounds was observed, suggesting that monitoring bowel sounds can provide valuable insights into a patient's recovery. Overall, this study underscores the importance of bowel sound monitoring as a critical component of postoperative care in patients undergoing general anesthesia.

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