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Research Article

Impact of Goal-Directed Fluid Therapy on Postoperative Recovery and Length of Hospital Stay in Major Abdominal Surgery

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ABSTRACT
Background: Goal-Directed Fluid Therapy (GDFT) has been increasingly utilised to optimise perioperative hemodynamics and improve surgical outcomes. This study evaluated the impact of GDFT on postoperative recovery and length of hospital stay in patients undergoing major abdominal surgery.
Materials and Methods: This comparative observational study was conducted in the Department of Anaesthesiology, Tezpur Medical Collegefrom January 2016 to January 2017. A total of 54 patients undergoing elective major abdominal surgery were included and divided into two groups: the GDFT group (n=27) and the conventional fluid therapy group (n=27). Demographic data, intraoperative fluid administration, postoperative recovery parameters, complications, and length of hospital stay were recorded and analyzed.
Results: Patients in the GDFT group received significantly lower intraoperative fluid volumes and demonstrated faster postoperative recovery. Time to ambulation, initiation of oral feeding, and return of bowel function were significantly shorter in the GDFT group compared to the conventional therapy group. The overall postoperative complication rate was lower in the GDFT group (14.8% vs. 37.0%). Mean hospital stay was significantly reduced in patients managed with GDFT (6.2 ± 1.8 days) compared with conventional fluid therapy (8.9 ± 2.4 days) ($p<0.001$).
Conclusion: Goal-Directed Fluid Therapy improves postoperative recovery and significantly reduces hospital stay in patients undergoing major abdominal surgery. Its use may contribute to better perioperative outcomes and enhanced recovery.

Keywords: Goal-Directed Fluid Therapy, Major Abdominal Surgery, Postoperative Recovery, Hospital Stay, Perioperative Care, Fluid Management.

INTRODUCTION

Major abdominal surgery is associated with substantial physiological stress, inflammatory responses, fluid redistribution, and hemodynamic alterations that may significantly influence postoperative recovery and clinical outcomes. Adequate perioperative fluid management remains one of the most important determinants of tissue perfusion, oxygen delivery, organ function, and surgical recovery. Both inadequate and excessive fluid administration can adversely affect patient outcomes. Hypovolemia may lead to tissue hypoperfusion, organ dysfunction, and postoperative complications, whereas fluid overload may result in interstitial edema, impaired wound healing, delayed gastrointestinal recovery, pulmonary complications, and prolonged hospitalization [1,2].

Traditionally, perioperative fluid therapy has been guided by static clinical parameters such as heart rate, blood pressure, central venous pressure, urine output, and estimated blood loss. However, numerous studies have demonstrated that these conventional indicators often fail to accurately predict intravascular volume status and fluid responsiveness [3]. Consequently, fluid administration based solely on traditional monitoring techniques may result in either under-resuscitation or excessive fluid replacement.

Goal-Directed Fluid Therapy (GDFT) has emerged as an evidence-based strategy designed to optimize perioperative hemodynamics through individualized fluid administration. GDFT utilizes dynamic parameters such as stroke volume variation, pulse pressure variation, cardiac output, cardiac index, and fluid responsiveness to

guide fluid management decisions [4]. The underlying principle of GDFT is to maximize stroke volume and optimize oxygen delivery while avoiding the harmful effects of fluid overload.

The concept of perioperative hemodynamic optimization was first introduced by Shoemaker and colleagues, who demonstrated that achieving supranormal oxygen delivery and cardiac output improved surgical outcomes in high-risk patients [5]. Since then, advances in minimally invasive cardiac output monitoring technologies have facilitated the wider implementation of GDFT in routine surgical practice. Several randomized controlled trials have shown that GDFT improves tissue perfusion, reduces postoperative complications, accelerates recovery, and shortens hospital stay in patients undergoing major surgery [6,7].

Enhanced Recovery After Surgery (ERAS) programs have further strengthened the role of individualized fluid therapy as a cornerstone of perioperative care. ERAS guidelines emphasize maintaining euvolemia and avoiding both hypovolemia and fluid excess, recognizing that optimal fluid management contributes significantly to improved postoperative outcomes [8]. Contemporary evidence suggests that integrating GDFT into ERAS pathways may further enhance recovery and reduce healthcare resource utilization [9].

Meta-analyses conducted over the last decade have consistently demonstrated that GDFT is associated with reduced rates of surgical site infections, cardiopulmonary complications, gastrointestinal dysfunction, and overall morbidity [10,11]. Furthermore, GDFT has been linked to reductions in intensive care unit admissions, duration of mechanical ventilation, and total hospital length of stay [12].

Despite increasing evidence supporting the use of Goal-Directed Fluid Therapy, its adoption remains inconsistent across healthcare institutions, particularly in developing countries where advanced hemodynamic monitoring may not be routinely available. Additional clinical studies are therefore required to strengthen the evidence base and evaluate the effectiveness of GDFT in different patient populations and healthcare settings.

The present study was undertaken to assess the impact of Goal-Directed Fluid Therapy on postoperative recovery parameters and length of hospital stay among patients undergoing major abdominal surgery.

MATERIALS AND METHODS

Study Design and Setting

This hospital-based comparative observational study was conductedin the Department of Anaesthesiology at Tezpur Medical College over a period of one year from January 2016 to January 2017. The study aimed to evaluate the impact of Goal-Directed Fluid Therapy (GDFT) on postoperative recovery and length of hospital stay among patients undergoing major abdominal surgery.

Study Population

A total of 54 patients scheduled for elective major abdominal surgery were enrolled in the study. Patients were divided into two groups:

- Group A (GDFT Group): 27 patients managed with Goal-Directed Fluid Therapy.
- Group B (Conventional Fluid Therapy Group): 27 patients managed according to standard perioperative fluid administration protocols.

Inclusion Criteria

- Patients aged 18–70 years.
- Patients undergoing elective major abdominal surgery under general anesthesia.
- American Society of Anesthesiologists (ASA) physical status I–III.
- Patients willing to participate and provide informed consent.

Exclusion Criteria

- Emergency surgeries.
- Severe cardiac dysfunction (ejection fraction <40%).
- End-stage renal disease.
- Severe hepatic impairment.
- Patients requiring reoperation during the same admission.
- Pregnant women.

Goal-Directed Fluid Therapy Protocol

In the GDFT group, intraoperative fluid administration was guided by hemodynamic parameters such as stroke volume variation, cardiac output, and mean arterial pressure using minimally invasive monitoring techniques. Fluid boluses of crystalloid or colloid solutions were administered based on predefined hemodynamic targets to optimize tissue perfusion and oxygen delivery.

Conventional Fluid Therapy Protocol

Patients in the conventional group received fluids according to standard institutional practice based on routine clinical parameters

including heart rate, blood pressure, urine output, and estimated blood loss.

Data Collection

The following variables were recorded:

- Demographic characteristics (age, sex, BMI).
- Type and duration of surgery.
- Intraoperative fluid volume administered.
- Estimated blood loss.
- Postoperative recovery parameters:
  - Time to first bowel movement.
  - Time to ambulation.
  - Time to initiation of oral feeding.
- Postoperative complications including surgical site infection, pulmonary complications, and acute kidney injury.
- Length of hospital stay (days).

Outcome Measures

Primary Outcome

- Length of postoperative hospital stay.

Secondary Outcomes

- Time to postoperative recovery milestones.
- Incidence of postoperative complications.
- Requirement for intensive care unit admission.
- Thirty-day postoperative mortality.

Statistical Analysis

Data were entered into Microsoft Excel and analyzed using SPSS version 22.0. Continuous variables were expressed as mean ± standard deviation (SD), while categorical variables were presented as frequencies and percentages. The Student's t-test was used for comparison of continuous variables, and the Chi-square test or Fisher's exact test was used for categorical variables. A p-value of less than 0.05 was considered statistically significant.

RESULTS AND OBSERVATIONS

A total of 54 patients undergoing major abdominal surgery were included in the study. Twenty-seven patients received Goal-Directed Fluid Therapy (GDFT Group), while 27 patients received conventional fluid therapy (Control Group). Baseline demographic characteristics were comparable between the two groups.

Table 1. Baseline Demographic Characteristics

Variable	GDFT Group (n=27)	Control Group (n=27)	p-value
Age (years)	53.8 ± 11.4	55.1 ± 10.8	0.67
Male, n (%)	16 (59.3%)	15 (55.6%)	0.78
Female, n (%)	11 (40.7%)	12 (44.4%)	0.78
BMI (kg/m²)	24.6 ± 3.5	25.1 ± 3.8	0.62
ASA Grade I/II/III	7/15/5	6/16/5	0.95

No statistically significant differences were observed between the groups with respect to baseline characteristics.

Table 2. Intraoperative Parameters

Parameter	GDFT Group (n=27)	Control Group (n=27)	p-value
Duration of Surgery (minutes)	182.5 ± 41.2	187.8 ± 44.5	0.65
Total Fluid Administered (mL)	2450 ± 520	3180 ± 610	<0.001
Estimated Blood Loss (mL)	410 ± 135	435 ± 148	0.51
Urine Output (mL)	610 ± 145	575 ± 138	0.36

Patients in the GDFT group received significantly lower intraoperative fluid volumes compared with the control group.

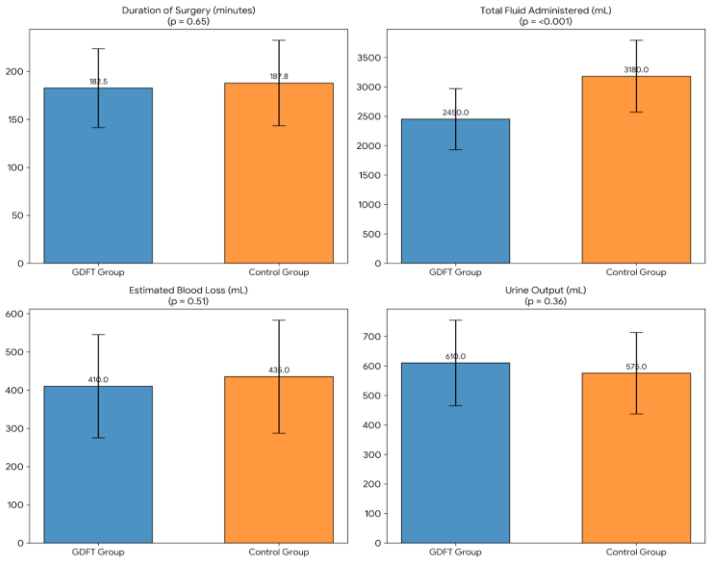


Figure 1: Intraoperative Parameters

Table 3. Postoperative Recovery Outcomes

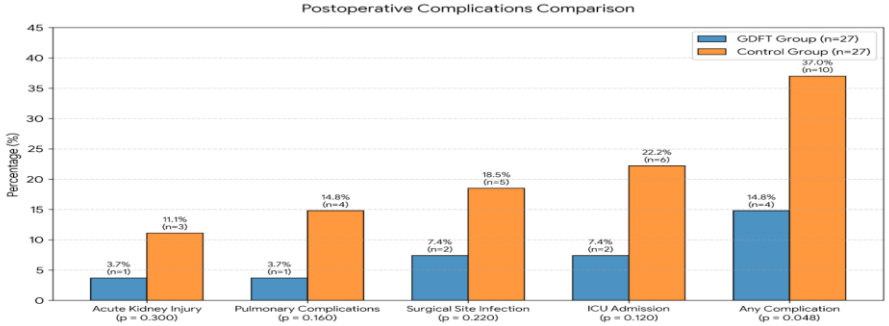
Outcome	GDFT Group (n=27)	Control Group (n=27)	p-value
Time to First Ambulation (hours)	20.4 ± 5.1	28.6 ± 6.3	<0.001
Time to Oral Feeding (hours)	30.7 ± 7.4	42.8 ± 9.1	<0.001
Time to First Bowel Movement (hours)	47.2 ± 11.5	61.3 ± 13.4	<0.001

Patients managed with GDFT demonstrated significantly faster postoperative recovery compared with those receiving conventional fluid therapy.

Table 4. Postoperative Complications

Complication	GDFT Group (n=27)	Control Group (n=27)	p-value
Surgical Site Infection	2 (7.4%)	5 (18.5%)	0.22
Pulmonary Complications	1 (3.7%)	4 (14.8%)	0.16
Acute Kidney Injury	1 (3.7%)	3 (11.1%)	0.30
ICU Admission	2 (7.4%)	6 (22.2%)	0.12
Any Complication	4 (14.8%)	10 (37.0%)	0.048

The overall postoperative complication rate was significantly lower in the GDFT group.



Figure; 2 Postoperative Complications

Table 5. Length of Hospital Stay

Parameter	GDFT Group (n=27)	Control Group (n=27)	p-value
Hospital Stay (days)	6.2 ± 1.8	8.9 ± 2.4	<0.001

The mean duration of hospital stay was significantly shorter in patients managed with Goal-Directed Fluid Therapy

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DISCUSSION

The present study evaluated the influence of Goal-Directed Fluid Therapy on postoperative recovery and hospital stay in patients undergoing major abdominal surgery. The findings indicate that GDFT significantly improved postoperative recovery, reduced complication rates, and shortened the duration of hospitalization when compared with conventional fluid management.

One of the most notable findings was the significantly lower volume of intraoperative fluids administered in the GDFT group. This observation supports the concept that individualized fluid administration allows optimization of intravascular volume status without exposing patients to unnecessary fluid loading. Excessive fluid administration has long been recognized as a contributor to tissue edema, impaired oxygen diffusion, delayed wound healing, pulmonary dysfunction, and prolonged recovery [13]. Brandstrup et al. demonstrated that fluid restriction and avoidance of perioperative fluid overload significantly reduced postoperative complications and improved surgical outcomes [14].

The present study also demonstrated significantly earlier ambulation, oral feeding, and return of bowel function among patients receiving GDFT. Gastrointestinal recovery represents an important component of postoperative rehabilitation following abdominal surgery. Excessive fluid administration can result in bowel wall edema, impaired intestinal motility, delayed gastric emptying, and prolonged postoperative ileus [15]. By optimizing tissue perfusion while minimizing interstitial edema, GDFT facilitates faster restoration of gastrointestinal function.

Our findings are consistent with those reported by Gan et al., who observed that goal-directed intraoperative fluid administration significantly reduced postoperative nausea, accelerated gastrointestinal recovery, and shortened hospital stay [16]. Similarly, Pearse et al. demonstrated that perioperative hemodynamic optimization reduced postoperative complications and enhanced recovery among high-risk surgical patients [17].

Another important finding of this study was the reduction in overall postoperative complications. Although individual complications such as pulmonary infections and surgical site infections were relatively infrequent, the cumulative complication rate was significantly lower in the GDFT group. These findings are supported by a meta-analysis conducted by Hamilton et al., which demonstrated that perioperative hemodynamic optimization reduced infectious complications, cardiovascular events, and organ dysfunction following major surgery [18].

The beneficial effects of GDFT are likely multifactorial. Optimization of stroke volume and cardiac output improves tissue oxygen delivery and microcirculatory perfusion. Adequate tissue oxygenation enhances wound healing, preserves organ function, and reduces susceptibility to postoperative infections [19]. Furthermore, avoidance of unnecessary fluid administration minimizes tissue edema and associated complications.

A particularly significant observation in the present study was the reduction in hospital length of stay among patients managed with GDFT. Hospital stay serves as an important indicator of postoperative recovery and healthcare efficiency. Patients receiving Goal-Directed Fluid Therapy were discharged earlier than those receiving conventional fluid therapy. Similar findings have been reported by numerous investigators. A systematic review by Corcoran et al. concluded that perioperative hemodynamic optimization consistently reduced hospital stay across multiple surgical specialties [20].

Recent evidence has further highlighted the role of GDFT within ERAS protocols. Miller et al. reported that individualized fluid therapy is one of the most important modifiable factors influencing enhanced recovery outcomes [21]. By reducing complications and facilitating earlier return of physiological function, GDFT contributes substantially to successful ERAS implementation.

The findings of the current study are also supported by the meta-analysis performed by Chong et al., which included several randomized controlled trials and demonstrated significant reductions in postoperative morbidity and hospital stay associated with goal-directed hemodynamic management [22]. Likewise, Giglio et al. reported improved gastrointestinal outcomes and lower complication rates in patients undergoing major abdominal procedures managed with GDFT [23].

Although the study demonstrated favorable outcomes with Goal-Directed Fluid Therapy, certain limitations should be acknowledged. The relatively small sample size may limit the statistical power for detecting differences in

less common complications. In addition, the single-centre nature of the study may restrict the generalizability of the findings. Future multicenter randomised studies involving larger patient populations are needed to further validate these observations.

Nevertheless, the present study provides additional evidence supporting the use of Goal-Directed Fluid Therapy in major abdominal surgery. The observed improvements in recovery parameters, reduction in postoperative complications, and shorter hospital stay underscore the clinical importance of individualised hemodynamic management during the perioperative period.

CONCLUSION

Goal-Directed Fluid Therapy significantly improved postoperative recovery and reduced hospital stay in patients undergoing major abdominal surgery. It was associated with faster recovery, fewer postoperative complications, and better overall clinical outcomes compared to conventional fluid therapy. Therefore, GDFT may be considered an effective perioperative fluid management strategy in major abdominal surgery.

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