RESEARCH PAPER

Effectiveness of Goal-Directed Fluid Therapy (GDFT) in Treatment of Acute Pancreatitis vs Standard IV Fluid Therapy

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ABSTRACT

Background: Acute pancreatitis (AP) is one of the most common surgical emergencies; with severity ranging from mild self-limiting inflammation to severe disease associated with systemic inflammatory response syndrome (SIRS), organ failure, and mortality. Fluid resuscitation is the cornerstone of management. However, the optimal strategy for fluid administration remains controversial. Goal-Directed Fluid Therapy (GDFT) offers a patient-specific, hemodynamically guided approach compared to conventional empirical fluid administration.

Aim: To evaluate the effectiveness of GDFT compared to standard intravenous (IV) fluid therapy in the management of acute pancreatitis.

Methods: A comparative study was conducted at a tertiary care teaching hospital in Maharashtra over two years. Forty-two patients diagnosed with acute pancreatitis were included into two groups: GDFT (n=21) and Standard Fluid Therapy (n=21). The GDFT group received stroke volume–guided crystalloid boluses with maintenance fluid, while the control group received conventional hydration (5–10 ml/kg/hour). Primary endpoints included safety, complications, ICU admission, and hospital stay. Statistical analysis was performed using SPSS v25.0.

Results: Recruitment feasibility was achieved (56% enrolment rate). Mean total fluid administered was lower in GDFT (8965.9 ml) compared to Standard Therapy (9571.4 ml), though not statistically significant (p=0.1691). Mean urine output was higher in GDFT (5719 ml vs 4632 ml, p=0.06). No significant differences were observed in mortality or major complications. ICU requirement was lower in the GDFT group. Length of hospital stay was marginally shorter in GDFT.

Conclusion: GDFT is feasible and safe in ward settings and may optimize fluid administration without increasing complications. The trends favour GDFT in improving physiological parameters and reducing ICU requirement.

Keywords: Acute pancreatitis; Goal-Directed Fluid Therapy; Fluid resuscitation; Hemodynamic monitoring; ICU admission.

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INTRODUCTION

Acute pancreatitis is an acute inflammatory disorder of the pancreas which is characterized clinically by severe epigastric pain; often radiating to the back and there are elevated serum amylase and lipase levels. Although the majority of cases are mild and resolve with supportive management, nearly twenty percent of patients develop moderate to severe disease which is accompanied by systemic inflammatory response syndrome and organ dysfunction. Severe acute pancreatitis patients have significant morbidity and mortality, mainly due to persistent organ failure and complications; those arising from pancreatic necrosis (1,2).

The pathophysiology of acute pancreatitis involves premature activation of pancreatic enzymes within acinar cells, which results in autodigestion and local inflammatory response. This inflammatory process triggers the release of cytokines such as interleukin-6 and tumour necrosis factor-alpha, leading to endothelial injury, increased vascular permeability, and capillary leak. As a result, a significant third-space fluid loss occurs, producing intravascular hypovolemia and hemo-concentration. Reduced pancreatic microcirculation further aggravates ischemia and necrosis. The systemic hypoperfusion contributes to multiorgan dysfunction (3,4).

In the absence of specific drug therapy, early and adequate fluid resuscitation is considered the most crucial aspect of the management of acute pancreatitis. Traditionally, fluid therapy has been administered empirically using generalized formulas without individualized hemodynamic assessment. Although aggressive hydration was historically recommended, newer evidence suggests that excessive fluid administration may precipitate pulmonary oedema, abdominal compartment syndrome, and cardiac dysfunction. On contrary, inadequate resuscitation may worsen tissue hypoperfusion and increase the risk of pancreatic necrosis (5).

Goal-directed fluid therapy (GDFT) represents a paradigm shift from empirical resuscitation toward individualized, physiology-based management. By utilizing dynamic hemodynamic parameters such as stroke volume and cardiac output, GDFT aims to optimize tissue perfusion while avoiding fluid overload. While this strategy has shown benefits in perioperative and critical care settings, evidence regarding its application in acute pancreatitis remains limited. This is especially true in cases of peripheral hospitals in non-metro cities. The present study was therefore undertaken to evaluate the effectiveness of GDFT compared to standard intravenous fluid therapy in patients with acute pancreatitis in a tertiary care hospital setting (6-10).

AIM AND OBJECTIVES

Aim:

To study the effectiveness of goal directed fluid therapy (GDFT) in management of acute pancreatitis.

Objectives:

1)To study an assessment of feasibility of trial.

2)To calculate the optimum crystalloid fluid volume required in management of acute pancreatitis.

3)To study the effectiveness of GDFT in decreasing complications of acute pancreatitis.

4)To study the effectiveness of GDFT by reducing the stay in ICU.

MATERIALS AND METHODS

This comparative study was conducted over a period of two years at MGM Medical College and Hospital, Chhatrapati Sambhajinagar, Maharashtra. All necessary administrative permissions were taken. The study was approved by the institutional ethics committee. The written informed consent was obtained from all participants. The sample size was calculated using G*Power software with an alpha of 0.05, power of 0.8, and effect size of 0.8, resulting in twenty-one patients per group, for a total sample of forty-two patients. The data was collected using a pre-designed, semi-structured questionnaire.

Patients admitted with a diagnosis of acute pancreatitis were screened for eligibility. The diagnosis was confirmed when at least two of the following criteria were met: characteristic abdominal pain consistent with pancreatitis, serum amylase or lipase levels elevated to at least three times the upper limit of normal, and imaging findings suggestive of acute pancreatitis on ultrasonography or contrast-enhanced computed tomography. Patients with chronic pancreatitis, recent fluid overload states such as cardiac failure or pleural effusion, or inability to provide informed consent were excluded.

Eligible patients were included into either the GDFT group or the standard therapy group. The intervention was continued for forty-eight hours, considered the critical early phase of disease management. In the GDFT group, patients received maintenance crystalloid fluid at 1.5 ml/kg/hour. Stroke volume was measured using transthoracic echocardiography by assessing the left ventricular outflow tract diameter and velocity time integral. If a sustained rise in stroke volume greater than ten percent was observed following a 250 ml fluid bolus administered over five to ten minutes, the patient was considered fluid responsive and additional boluses were given until no further increase in stroke volume was achieved.

Stroke volume was reassessed every four hours to guide ongoing therapy.

In the standard therapy group, patients received conventional crystalloid hydration at a rate of 5–10 ml/kg/hour for forty-eight hours without stroke volume-guided boluses. Clinical parameters including heart rate, blood pressure, respiratory rate, oxygen saturation, urine output, and laboratory values were monitored in both groups. Severity scores and complications were documented.

Data was entered in MS Office Excel 365 and analysed using SPSS version 25.0. Continuous variables were expressed as mean and standard deviation, while categorical variables were expressed as proportions. An unpaired t-test was used to compare means between groups, and chi-square test was applied for categorical variables. A p-value less than 0.05 was considered statistically significant. The data was presented using tables and graphs wherever necessary.

RESULTS

This study was also intended for checking feasibility of GDFT in tertiary care set up in non-metro city. Evaluation in ward setting instead ICU and cardiac output monitoring was possible. Recruitment rate was achievable. Treatment was started withing 6 hours and completed in 48 hours as per protocol. Financially, the trial was sound.

All patients completed the forty-eight-hour intervention protocol, and cardiac output monitoring using echocardiography was successfully implemented in the ward setting without the need for ICU admission at baseline.

The baseline demographic characteristics of the two groups were comparable. The mean age in the GDFT group was 36.4 years, while in the standard therapy group it was 41.05 years, with no statistically significant difference. The majority of participants in both groups were male. Alcoholism was identified as the most common etiological factor in both groups, followed by gallstone disease and hypertriglyceridemia. All the participants had abdominal pain. It was either associated with vomiting or fever. Other symptoms in GDFT group include abdominal distension while the same in standard therapy group include headache, abdominal distension and loose motions. Symptoms in both the groups were statistically not significant. The Mean duration of presenting symptoms was more in standard therapy. As unpaired t test was not significant, both the groups were comparable.

Among the study participants, Tachycardia was the most common clinical finding in both the groups. It was followed by fever in both. In GDFT group, abdominal guarding / rigidity was present in two participants while Cullen's and Grey Turner's sign was present in one participant. Jaundice was absent among both the group participants. Most common clinical diagnosis was acute pancreatitis in both the groups. It was followed by acute necrotizing pancreatitis with peripancreatic collection in GDFT group. However, the other diagnoses were present in single patients in standard therapy group except AP with cholelithiasis.

The mean total fluid administered over forty-eight hours was slightly lower in the GDFT group compared to the standard therapy group, although the difference was not statistically significant. Despite receiving marginally less fluid, patients in the GDFT group demonstrated higher mean urine output compared to the standard therapy group, suggesting more efficient intravascular volume optimization. The difference approached but did not reach statistical significance.

Hemodynamic parameters showed favourable trends in the GDFT group, including better stabilization of heart rate and maintenance of stroke volume. No significant difference was observed in the incidence of early or late complications between the two groups. Importantly, ICU admission was less frequent in the GDFT group, and the duration of hospital stay was marginally shorter compared to the standard therapy group.

No mortality was recorded in either group during the study period. The intervention was found to be financially feasible and practically implementable in the ward setting.

DISCUSSION

In patients with acute pancreatitis (AP), this study sought to compare the safety and effectiveness of goal-directed fluid treatment (GDFT) to standard therapy. Although fluid resuscitation is a fundamental component of AP therapy, research on the best approach is still underway. This study has also thrown light on feasibility and safety aspect along with addition to scientific evidence.

The present study demonstrates that goal-directed fluid therapy is feasible and safe in patients with acute pancreatitis managed in a tertiary care ward setting. The recruitment rate and completion of protocol indicate that such a trial is practical in a non-ICU environment, even in resource-constrained institutions.

Although the differences in primary clinical outcomes were not statistically significant, several clinically meaningful trends favour GDFT. Patients in the intervention group achieved higher urine output with slightly lower total fluid administration, suggesting improved hemodynamic efficiency. This finding supports the theoretical advantage of individualized fluid resuscitation based on dynamic parameters rather than fixed empirical rates.

Excessive fluid resuscitation in acute pancreatitis has been associated with adverse outcomes such as pulmonary edema and abdominal compartment syndrome. By tailoring fluid administration to stroke volume response, GDFT minimizes the risk of fluid overload while ensuring adequate perfusion. The

absence of increased complications in the GDFT group further reinforces its safety profile.

The clinical trial conducted by F. Froghi et al. serves as a primary comparison for our study. Both studies exhibited comparable baseline characteristics concerning age, gender, clinical presentation, relevant history, clinical findings, and diagnosis. Notably, while Froghi et al. reported similar amounts of intravenous fluid administration between groups (GDFT 5465 ml, SC 5211 ml), our findings indicated a higher means for both groups (GDFT 8965.9 ml, SC 9571.4 ml). Furthermore, findings from Froghi et al. concerning physiological indicators such as blood pressure, heart rate, and oxygen saturation align with our observations, which demonstrated improved outcomes in the GDFT group, albeit with slight differences. While Froghi et al. included three severely ill patients, our study encompassed ten. Both studies identified side effects associated with GDFT. Additionally, Froghi et al. noted negligible differences in length of critical care stay or complications, whereas our study found the GDFT group's mean hospital stay to be shorter (11.81 days) compared to the standard group (13.38 days), consistent with Froghi et al.'s conclusions regarding reduced hospital stays associated with GDFT.

FIGURES

The results of this study align with previous feasibility trials demonstrating that GDFT can be implemented outside intensive care units. The use of non-invasive echocardiographic monitoring makes the approach accessible and cost-effective. However, the relatively small sample size may have limited the ability to detect statistically significant differences in complications and hospital stay (10-15).

Such large studies are necessary to evaluate long-term outcomes, mortality benefits, and cost-effectiveness. Additionally, standardization of GDFT protocols and training in bedside echocardiography will be essential for widespread adoption.

CONCLUSION

Goal-directed fluid therapy in acute pancreatitis is feasible, safe, and practically implementable in ward settings. While statistically significant superiority over standard fluid therapy was not demonstrated, GDFT showed favourable trends in fluid optimization, urine output, ICU requirement, and hospital stay. Individualized hemodynamic-guided resuscitation may represent a balanced and rational approach to fluid management in acute pancreatitis. Further large-scale studies are warranted to establish definitive clinical benefits.

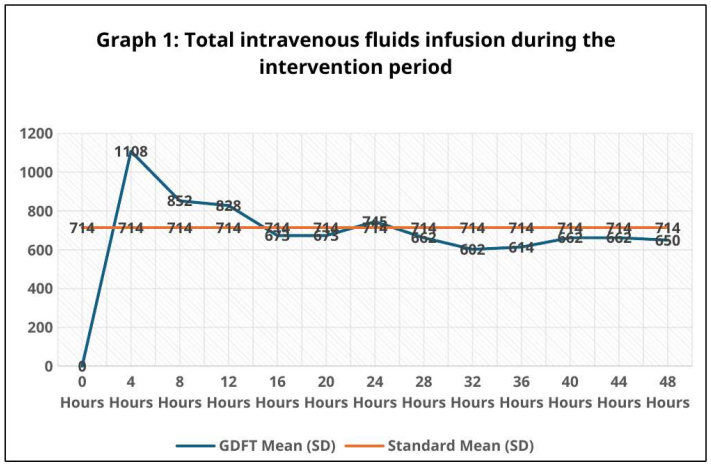

Figure Total intravenous fluids infusion during the intervention period

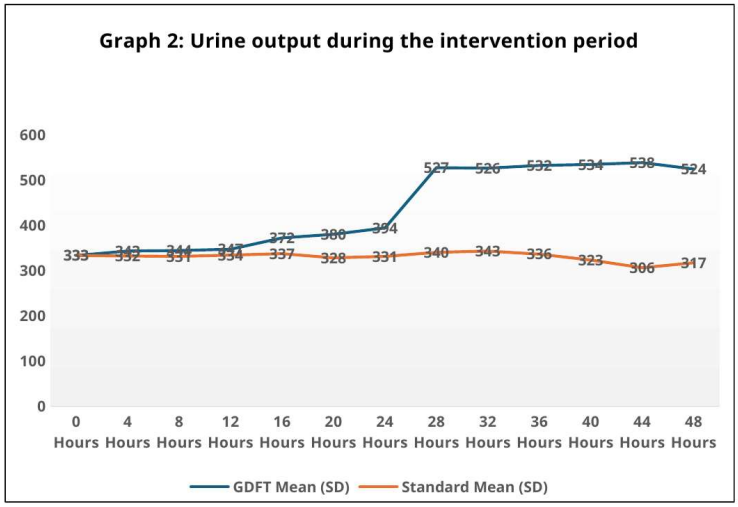

Figure Urine output during the intervention period

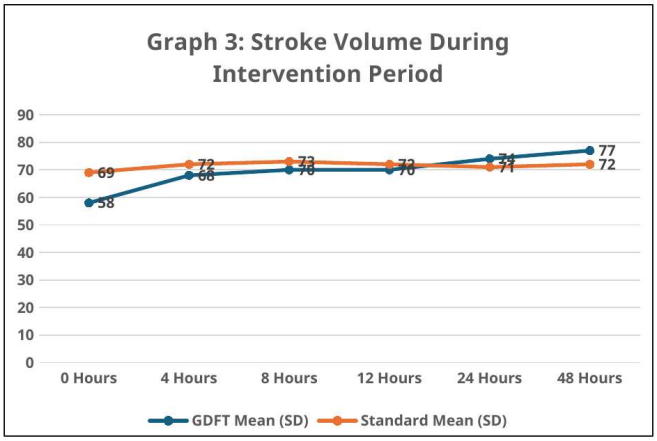

Figure Stroke Volume During Intervention Period

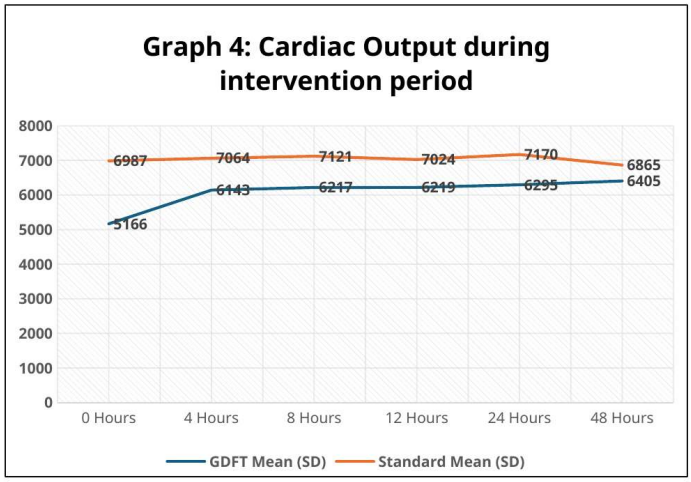

Figure Cardiac Output during intervention period

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