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RESEARCH ARTICLE
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THE EFFICACY OF ULTRASOUND GUIDED ILIOINGUINAL (II) AND ILIOHYPOGASTRIC (IH) NERVE BLOCK IN PROVIDING EFFECTIVE INTRAOPERATIVE ANALGESIA FOR ELECTIVE UNILATERAL INGUINAL HERNIA REPAIR IN ADULTS

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Abstract

Background: Inguinal hernia is one of the common surgical procedures and the most used anaesthetic technique is neuraxial anaesthesia particularly spinal anaesthesia. We studied the efficacy of ultrasound guided ilioinguinal (II) and iliohypogastric (IH) nerve block in providing effective intraoperative anaesthesia analgesia for unilateral inguinal hernia repair in adults as an alternative to spinal anaesthesia when it is contraindicated.

Material and methods: This is a prospective observational study conducted from June 2017 to Dec 2019 at a tertiary teaching hospital in South India. A total of 100 adult patients were included in the study. All patients were administered ultrasound guided II and IH nerve block for unilateral inguinal hernia repair. Sensory block was used assessing cold alcohol skin prep and pin prick method.

Results: Among 110 patients administered ultrasound guided II and IH nerve block, surgery was successfully completed in 100 patients and 10 patients required general anaesthesia to complete the procedure. Preoperative baseline and intraoperative heart rate (HR) and mean blood pressure (MAP) variations were within 20%.

A paired t test was used to find the significance between baseline preoperative and mean of maximum recorded intra operative HR and MAP. HR and MAP variations were 10.86% and 7.08% respectively. Although the test was statistically significant ($p<0.001$), It was not clinically significant as variations in intraoperative HR and MAP were well within 20% of preoperative values.

Conclusion: Ultrasound guided ilioinguinal (II) and iliohypogastric (IH) nerve block provided excellent intraoperative analgesia and anaesthesia. There were less incidence of post operative complications, post operative pain, requirement of post operative analgesics and more patient satisfaction.

Introduction:
Inguinal hernia repair is one of the most common procedures in general surgery (1). All anaesthetic techniques like general anaesthesia, regional anaesthesia and local anaesthesia can be used in hernia repairs (2). Local anaesthesia for hernia repair had been introduced at the very beginning of last century. It gained fame following the success reports from Shouldice hospital, Thornhill, Ontario, Canada and the Lichtenstein hernia institute, Los Angeles, USA. Local anaesthesia is usually used in special hernia repair centres. Despite its proven advantages and recommendations by current hernia repair guidelines, its use is still not a common practice in other general hospitals.

Local anaesthesia technique has several advantages over general anaesthesia and spinal anaesthesia (3). Its use in hernia repair favour health care economics. It requires a shorter time in the operating suite. It causes less post operative pain, requires less analgesic consumption. There is lesser incidence of post operative nausea and vomiting. It reduces the incidence of post operative urinary retention. Patients can be mobilized early in the post operative period. Patient can be started orally much earlier (4). Local anaesthesia is also more suitable type of anaesthesia in elderly patients and patients with poor physical status (American Society of Anaesthesiologists (ASA) physical status III & IV) (5). Local anaesthetic drugs are relatively safe if administered in an appropriate volume and dosage and in the correct anatomic location.

Ultrasound has become a standard of care for nerve block techniques. Ultrasound allows direct visualization of the nerve, needle and local anaesthetic distribution. It will help to reduce the volume of the drug needed to block the nerve (6), will prevent and detect critical events such as intravascular injection. Use of ultrasound guided ilioinguinal and iliohypogastric nerve block with propofol sedation can provide excellent anaesthesia and analgesia for inguinal hernia repair.

Aim & Objective:
To determine the efficacy of ultrasound guided ilioinguinal nerve block in providing effective intraoperative analgesia for unilateral inguinal hernia repair in adults.

Objectives:
The primary objective is to study the efficacy of ultrasound guided ilioinguinal nerve block in providing effective intraoperative analgesia for inguinal hernia repair in terms of the following

I) Study the volume of local anaesthetic needed for effective ilioinguinal nerve block
II) Study the dose of Propofol required for sedation and monitored anaesthesia care
III) Assess pain in the post operative period using Visual analog scale
IV) Study the side effects of ultrasound guided ilioinguinal nerve block in these patients

The secondary objectives of this study include
I) Study the mean distance from anterior superior iliac spine along the anterior superior iliac spine to umbilicus line at which ilioinguinal nerve is found
II) Study the mean depth from skin at which ilioinguinal nerve is found

Materials and methods:
This study design was a prospective observational study conducted at a tertiary care centre After approval from hospital ethics committee, one hundred adult patients scheduled for unilateral inguinal hernia repair were included in the study. Written informed consent was taken from all patients.
Patients with ASA physical status I & II, aged between 15 and 65 years, scheduled for elective inguinal hernia repair were assessed for eligibility. Paediatric age group, pregnant women, patients with morbid obesity, patients with a history of cardiovascular, respiratory, renal, hepatic and

metabolic disease, active gastrointestinal reflux, known drug allergies to drugs being used, substance abuse, bleeding diathesis & coagulopathy were excluded.

Preoperative assessment was carried out to all patients. Mandatory preoperative investigations were limited to complete blood count and urine routine examination. Blood grouping and typing and serology (HbsAG, HIV and HCV) were carried out as per institution protocol for surgical patients. Other investigations (liver function test, renal function test, chest X ray, electrocardiogram, echocardiography) were carried out depending upon indications and clinical status of the patient. All patients were kept nil by mouth, 6 hours for solids and 2hrs for clear fluids prior to surgery.

On arrival to operating room, peripheral wide bore intra venous access was established. Balanced salt solution (Ringer lactate, 10 ml/kg) was given to the patient. Patients were attached to standard monitoring. All the nerve blocks were performed in the preoperative waiting room under aseptic precautions. A sonosite model (Sonosite S - Nerve, Bothel, WA, USA with Transducer (L - 38, 5 - 10 MHz) was used to explore the regional anatomy and to perform the block. Before an ultrasound examination started, anterior superior iliac spine (ASIS), ilioinguinal ligament and line connecting the ASIS with the umbilicus were marked.

The transducer was slowly moved along then ASIS - umbilicus line. A 22G, 10 cm blunt tipped needle was inserted lateral to the transducer and advanced using in plane approach. Needle insertion point was above and 1 to 2 cm medial to the anterior superior iliac spine. Needle was inserted into external oblique and internal oblique plane and advanced further into internal oblique and transverse abdominis fascial plane. Ilioinguinal and iliohypogastric nerves lie in this plane and often appear as small hypo echoic structures. The branch of the deep circumflex iliac artery often lies at the same plane which can be identified and delineated by colour Doppler. 0.5% isobaric bupivacaine was injected to block both nerves and the volume of drug used to completely bathe nerves were noted. Local anaesthetic dose was limited to less than or equivalent to 2mg/kg.

Patients were shifted to the operating room. Sensory function was assessed by application of cold using the alcohol skin prep and pin prick at 15 minutes. A target controlled propofol infusion at a rate of 25 mcg/kg/min was started and dose was titrated to maintain a sedation score of 2. Ten ml of 2% lignocaine was used to infiltrate the skin prior to incision. All patients received intra operative intravenous Paracetamol 1 gm. Failure of the block was defined as the need for additional intraoperative local anaesthesia or deepening of sedation with large doses of propofol (> 75mcg/kg/min). During the surgery heart rate & rhythm, blood pressure and oxygen saturation were assessed at a five-minute interval. Increase in heart rate or blood pressure or both more than 20% from the base line during surgery in the absence of other causes considered inadequate block. Inj fentanyl 2mcg/kg/min was given as a rescue analgesia. In case of further difficulty faced by the surgeon, general anaesthesia was administered by additional doses of propofol along with muscle relaxant (Inj atracurium 0.5 mg/kg) followed by tracheal intubation and these patients were excluded from the study. Volume of local anaesthetic required for the nerve block, dose of propofol required for the sedation and depth at which nerves visualized were noted.

Post operative pain was assessed using visual analog scale in the post anaesthesia care unit (PACU). Pain was assessed upon arrival in the PACU and every 30 minutes until transferred to the ward. In the ward, pain was assessed second hourly for next 6 hours. Patients with VAS score more than 3 received intravenous diclofenac 1 mg/kg. All the above data were collected by two independent observers (one at PACU and other at ward), blinded to the study protocol.

Data analysis was done by using SPSS version 17.0. Descriptive statistics was used. Data are presented as mean ± SD and numbers. Paired t test was used to find the significance between mean preoperative and intra operative heart rate and mean arterial pressure. P value < 0.05 was considered significant for statistical purpose.

Results:

A total of 110 patients were assessed and found to be eligible for the study. The study was conducted from June 2017 to December 2019. An ultrasound guided ilioinguinal and iliohypogastric nerve block was performed in all 110 patients. Of the total 110 patients, 10 patients were excluded from the study as they required general anaesthesia to complete the surgery due to inadequate nerve block. After excluding these 10 patients, 100 patients were finally analysed as shown in the **figure 1.**

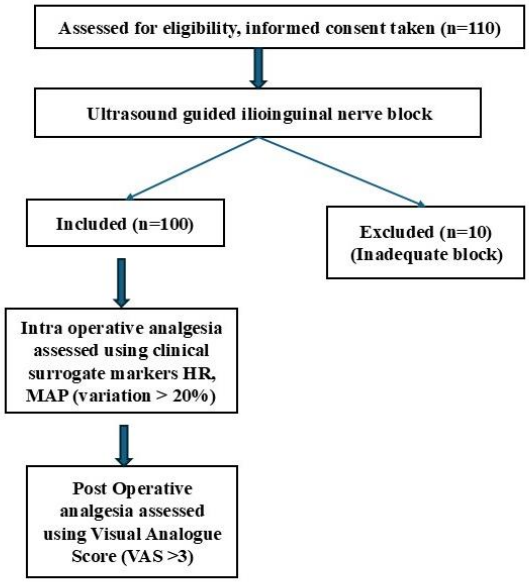

Figure 1: Consort diagram of patient's recruitment for the study

The demographic characteristics of patients are shown in **Table 1.**

Table 1. Demographic profile. Values expressed as mean ±SD

Parameter	Values (n = 100)
Age (Yr)	44.63 ± 12.43
Weight (Kg)	62.05 ± 6.64
Height (cm)	166.18 ± 5.05

The age wise distribution of study population is presented in **figure 2** and all patients participated in the study were male.

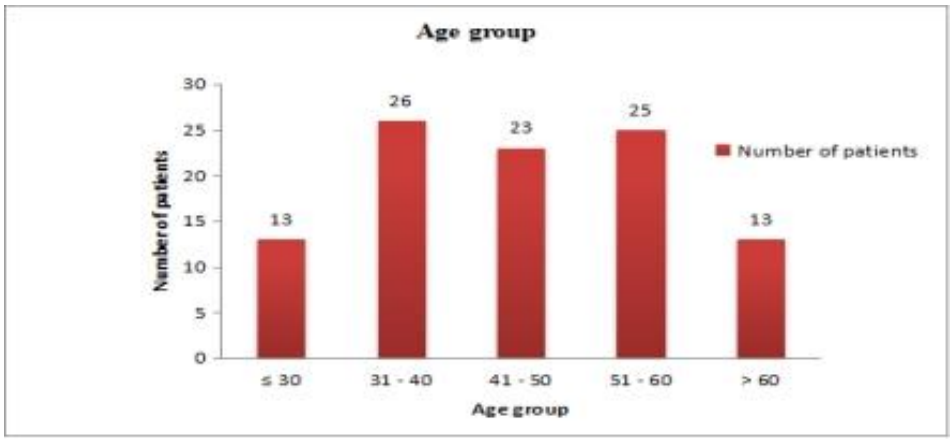

Figure 2: Age wise distribution

Of 100 patients, 25 patients were accepted under ASA physical status II as shown in **figure 3**. Of the total 25 patients, 12 patients had controlled hypertension, 9 patients had type 2 diabetes mellitus, 3 patients had bronchial asthma and 1 had Gilbert's syndrome.

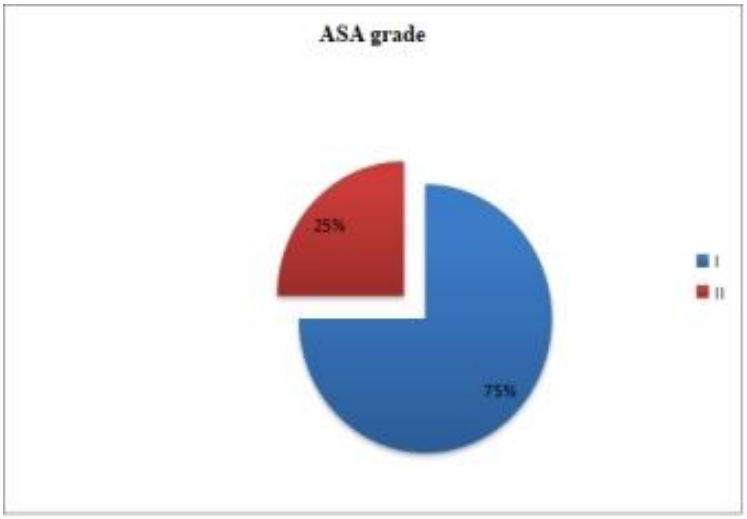

Figure 3: ASA grade

The main outcome of the study is shown in **Table 2** .

Table 2. Preoperative and intra operative data. Values are expressed as mean ± SD, HR - Heart rate, MAP - Mean arterial pressure

Parameter	Values
Volume of 0.5% Bupivacaine (ml)	20.18 ± 1.13
Propofol (mg)	218.8 ± 26.22
Preoperative HR (beat/min)	70.25 ± 7.2
Intraoperative HR (beat/min)	77.88 ± 8.92
Preoperative MAP (mmHg)	83.32 ± 7.1
Intraoperative MAP (mmHg)	89.22 ± 7.81

The secondary outcomes of the study are shown in **Table 3.**

Table 3. Secondary outcome of the study. Values are expressed as mean ± SD, ASIS - Anterior superior iliac spine, IIN - Ilioinguinal nerve)

Parameter	Values
Distance of probe from ipsilateral ASIS at which IIN found (mm)	20.18 ± 1.13
Depth of IIN from skin (mm)	39.48 ± 2.8
Duration of surgery (min)	73.90 ± 7.3

The preoperative baseline and intra operative HR variations are shown in **figure 4 & 5**. Intra operative variation from preoperative baseline was within 20%.

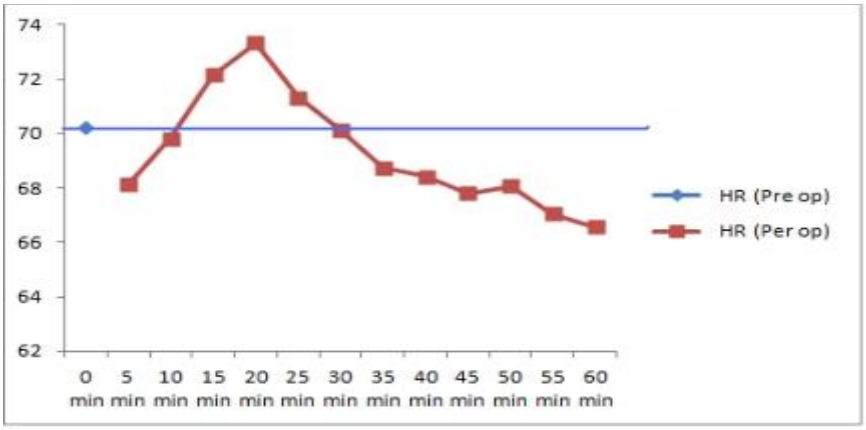

Figure 4: Preoperative & intraoperative HR variation

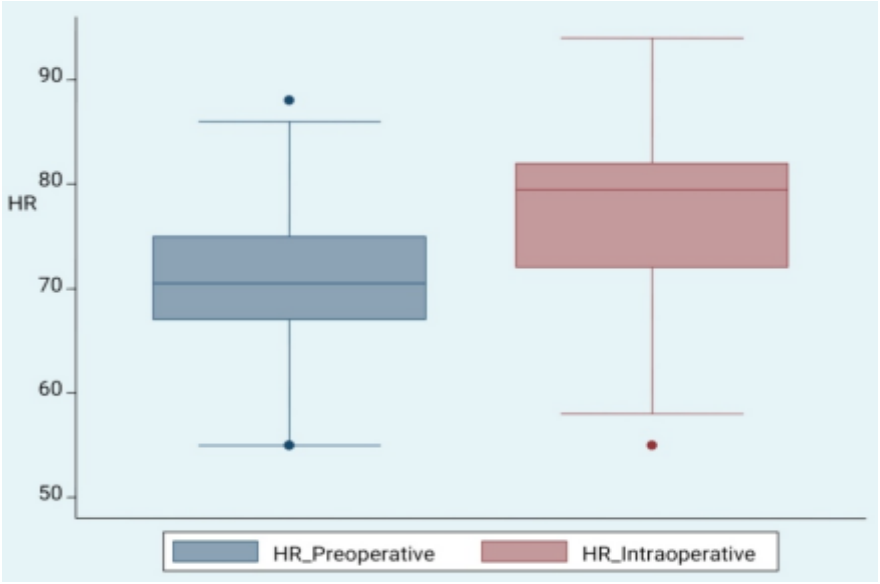

Figure 5: Box plot of preoperative and intra operative HR

The preoperative baseline and intra operative MAP variations are shown in **figure 6 & 7**. Intra operative variation from preoperative baseline was within 20%.

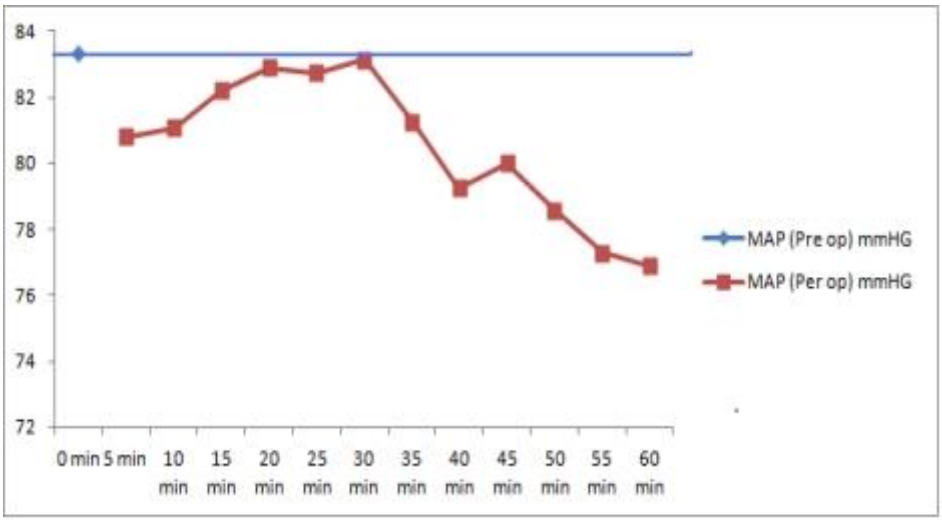

Figure 6: Preoperative and intra operative MAP variation

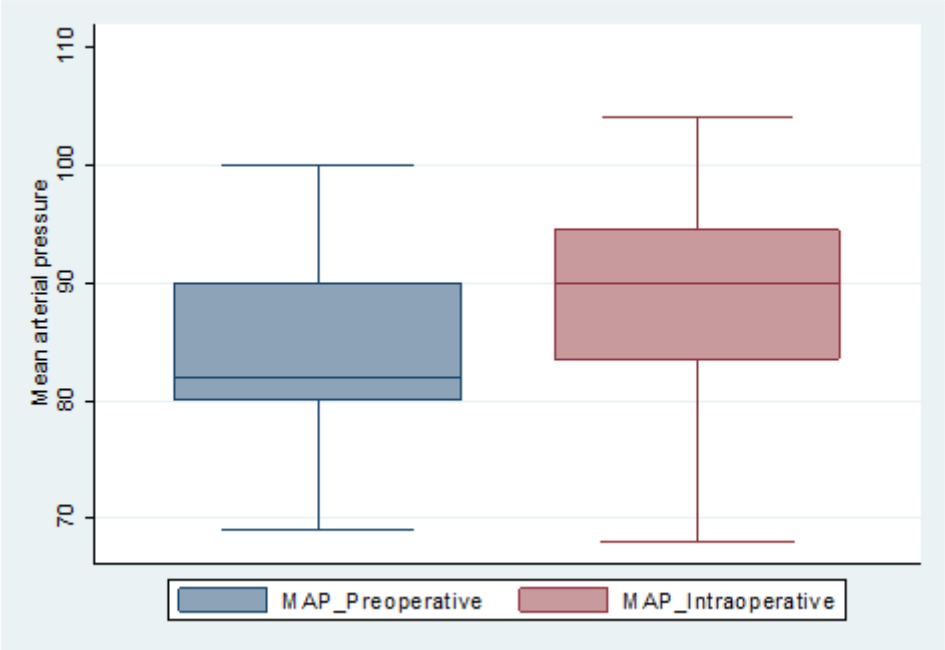

Figure 7: Box plot of preoperative & intraoperative MAP

A paired t test was used to find the significance between baseline preoperative and mean of maximum recorded intra operative HR and MAP. The HR and MAP variation were 10.86% and 7.08% respectively. Although the test was statistically significant ($p<0.001$), It was not clinically significant as variation in intraoperative HR and MAP were well within 20% of preoperative values.

A comparison of preoperative and mean of maximum recorded intraoperative HR and MAP is shown in **Table 4**.

Table 4: Comparison of preoperative and mean of maximum recorded intraoperative HR and MAP. Values are expressed as mean ± SD, HR - Heart rate, MAP- Mean arterial pressure

Parameter	Preoperative	Intraoperative	P value
HR	70.25 ± 7.2	77.88 ± 8.92	< 0.001
MAP	83.32 ± 7.1	89.22 ± 7.81	< 0.001

In the PACU, on immediate arrival no patient had pain. After 30 minutes, only 5 patients (5% of the total patients) had VAS score of 4 and received post operative analgesia before shifting to ward. No patient had VAS score of ≥5. In the ward, only 7 patients after 2 hours, 3 patients after 4 hours, 4 patients after 6 hours received post operative analgesia. 3 patients were catheterized for urine retention. All the patients were discharged within 24 hrs.

Discussion:

This study demonstrates that the use of an ultrasound guided Ilioinguinal and Iliohypogastric nerve block with propofol sedation for inguinal hernia repair provides significant advantages. Results from this descriptive study of 100 male patients showed that ultrasound guided nerve block resulted in an effective intra operative analgesia and significant reduction in opioid requirement in the post operative period. Success of the block depends on accurate injection of local anaesthetic in the plane between internal oblique and transverse abdominis muscle. Ultrasound guides to identify the correct anatomical plane and place the needle tip at exact point. Overall success of this study was 90.9% which is comparable to cadaveric study done by Eichenberger et al (7) which showed success rate of 95%. The success rate of landmark technique is approximately 70% to 80% (8). Efficacy to provide intra operative analgesia was assessed using clinical surrogate markers (heart rate & mean arterial pressure) and patient movement due to pain. Mean intra operative heart rate and mean arterial pressure variations were within 20%.

No adverse effects in respect to ultrasound guided nerve block were reported. Adverse effects due to landmark based blind technique were totally avoided. Propofol was used for intraoperative sedation. Dose of propofol (218.8 ± 26.22) used for monitored anaesthesia care was also considerably less as compared to landmark technique study done by Song D et al (312 ±192) (9). This study showed significant pain reduction in the post operative period. There was no opioid requirement intra operatively as well as post operatively. Only 5% patients had VAS score > 3, thirty minutes after arrival to PACU. Number of patients having significant VAS score post-surgery was negligible. This result confirms the reduction of post operative pain resulting from the USG IIN/IHN block demonstrated previously in adults undergoing inguinal hernia repair by Baerentzen F et al (8). This technique was associated with the low incidence of urinary retention and PONV. Data from other studies suggest that incidence of urinary retention is lowest with local anaesthesia compared with both regional and spinal anaesthesia. Speed of recovery, patient comfort and cost associated with the surgery were cost effective as reported in studies done by Song D et al (9).

Inguinal hernia repair can be done under spinal anaesthesia or general anaesthesia. But these two techniques can lead to more post operative complications compared to local anaesthesia technique (10) (11). Ultrasound guided ilioinguinal and iliohypogastric nerve block provides excellent intra operative analgesia and anaesthesia. There is less incidence of post operative complications, post operative pain, requirement of post operative analgesics and more patient satisfaction. This technique reduces the hospital stay and shortens the time to discharge.

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