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RESEARCH ARTICLE
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ROLE OF TRANEXAMIC ACID ON REDUCING BLOOD LOSS WITH REPEAT C-SECTIONS

Dr. Srinandhini[1], Dr. Geetha J[2], Dr. Nuzhat Zeba[3*]

[1]Assistant Professor, Department of Obstetrics and Gynaecology, Dhanalakshmi Srinivasan Medical College and Hospital, Siruvachur, Perambalur, Tamil Nadu, India.
[2]Associate Professor, Department of Anesthesialogy, Dhanalakshmi Srinivasan Medical College and Hospital, Siruvachur, Perambalur, Tamil Nadu, India.
[3*]Associate Professor, Department of Obstetrics and Gynaecology, Dhanalakshmi Srinivasan Medical College and Hospital, Siruvachur, Perambalur, Tamil Nadu, India.

***Corresponding Author:** Dr. Nuzhat Zeba
***Associate Professor, Department of Obstetrics and Gynaecology, Dhanalakshmi Srinivasan Medical College and Hospital, Siruvachur, Perambalur, Tamil Nadu, India.

ABSTRACT

INTRODUCTION

Anemia in women has been widely evaluated, studied and prevention with management measures have been implemented as a national programme. Blood loss from menstruation and delivery apart from nutritional cause have been attributed as major causes of acute and chronic anemia. Use of antifibrinolytic agent has been adopted in management of atonic post-partum hemorrhage and in gynec patients leading to abnormal uterine bleeding. In this Study, we interd to study the role of tranexemic acid administered along with induction of regional anesthesia in patients undergoing repeat C-sections. The study population was chosen as Repeat C-sections pose more threat to excessive blood loss due to previous uterine scar, tissueand bladder adhesions, impending rupture uterus and predisposition to atonic post-partum hemorrhage.

Aim

To evaluate the efficacy of tranexamic acid in reducing blood loss in repeat C-sections.

Objectives

To compare the drop in post-operative hemoglobin and intra Operative blood loss. To evaluate the effect of pre-operative hemoglobin and infant birth weight to suggest safe use of tranexemic acid in the perinatal period to prevent anticipated excessive blood loss. .

MATERIALS AND METHODS

Study Material

All antenatal patients presenting for repeat C-section delivery to the obstetrics OP with no systemic co-morbidities.

Study Period- September. 2024 TO December. 2024
Study- Prospective Observational Study
Study Sample- 48
Methods

All antenatal patients presenting to obstetrics OP under ASA I and II with history of previous C-section now admitted for repeat C-section were included in the study. Through antenatal workup, counselling and consent were obtained. The BMI, Pre-operative and post- operative hemoglobin, amount of blood loss in the form of number of soaked pads and gauzes apart from suction content, infant birth weight were noted and tabulated. All patients received 500mg Tranexemic acid in 100ml normal saline intravenous over a period of 7-10 minutes as soon as they were placed on the table and the monitors were connected.

RESULTS
No reactions or hemodynamic changes due to tranexemic acid were noted in ant of the patients. An average of 4 full soaked gauzes and 3-4 fully soaked moping pads (dry weight- 30gms) were noted in all patients. No extra dose of tranexemic acid was needed in patients with higher BMI. Infant birth weight was unaffected with blood loss or BMI or hemoglobin levels.

CONCLUSION
Tranexemic acid can be safely used during induction of anesthesia in repeat C-sections with minimal blood loss and nil side effects.

INTRODUCTION

Anemia in pregnancy has been listed as one of the major complications (66.4%) as per a large study in India. The causes reported were mainly nutritional. Anemia has a serious impact on maternal and fetal well-being, with long-term effects on the mother.

Postpartum anemia has been reported to be 34.2% in a large study done in 2022 at the community level health care by Alex Mremi et al.[1] Though postpartum anemia could be an extended antepartum anemia, blood loss in pregnancy is a major contributor to anemia, which remains uncorrected even for a lifetime in an average Indian woman.

Operative deliveries potentiate more blood loss than normal vaginal deliveries. Repeat C-sections have added causes of adhesions. Threatened uterine rupture, neovascularization, uterine inertia, uterine myometrial fatiguability, increased risk of postpartum atony, comorbidities such as gestational hypertension or gestational diabetes as added causes for hemorrhage.

Prevention and treatment of atonic postpartum hemorrhage has been largely studied with use of tranexamic acid. This study focuses on intra-operative blood loss that may be preventable by the use of tranexamic acid during induction of anesthesia.[2-4]

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Study Sample: 48

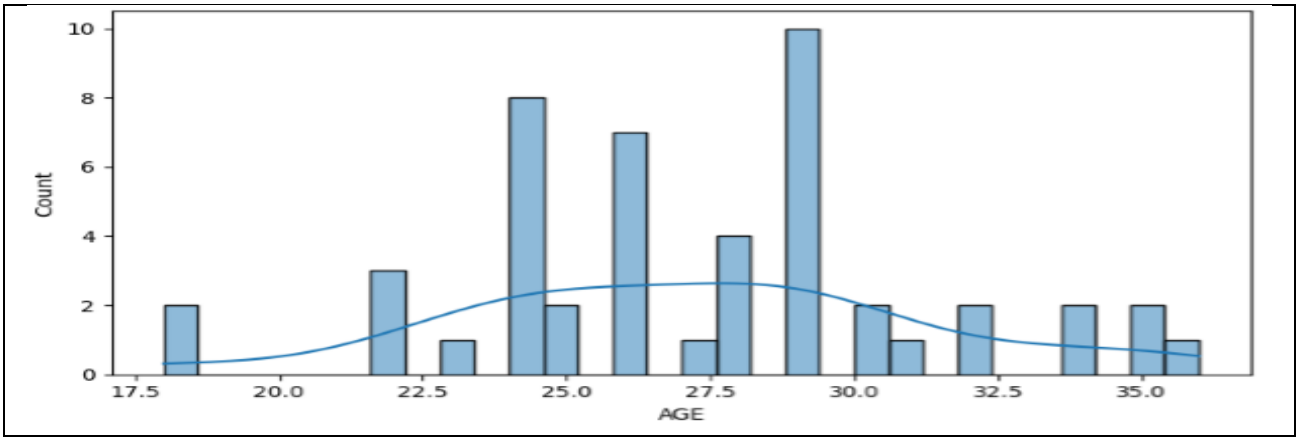
Methods

All antenatal mothers presenting to the obstetric OP under ASA 1 & 2 with a history of prior

delivery by C-section were taken up for the study. A thorough antenatal workup, counseling, and informed consent were taken.
Height, weight, and BMI of all patients, along with antepartum hemoglobin levels, were noted. All patients were wheeled in the left lateral position to the operating room, and standard monitors were connected.
Inj. Tranexamic acid 500mg in 100ml normal saline was administered through a separate 18G intravenous catheter, followed by an infusion of Ringer Lactate.
All patients had lumbar subarachnoid block with 0.5% Bupivacaine heavy 2ml at L3L4 space in the lateral position.
The dry weight of standard gauze was 10 grams and the mopping pad was 30 grams, measured in an infant weighing balance.
On incision, fully soaked gauzes and pads were kept aside, and numbers were noted. The blood ooze from the surgical site was focused more than total loss in the suction bottle to avoid errors. The amount of liquor into the suction bottle and placental weight & blood retained in the cord of the delivered placenta were excluded from calculations.
Complicated deliveries or abnormal placental positions & separation were excluded from the study. The number of fully soaked pads and gauzes was noted. All patients had a stable pulse and blood pressure and received 1.5 liters of crystalloid in the intra-operative period.
The average intra-operative period from skin incision to skin closure was 40 to 50 minutes. All patients received 20 units of oxytocin as an intravenous infusion as uterotonics, and there were no cases of atonic postpartum hemorrhage. Post-operative hemoglobin was evaluated on the first post-operative day and noted.

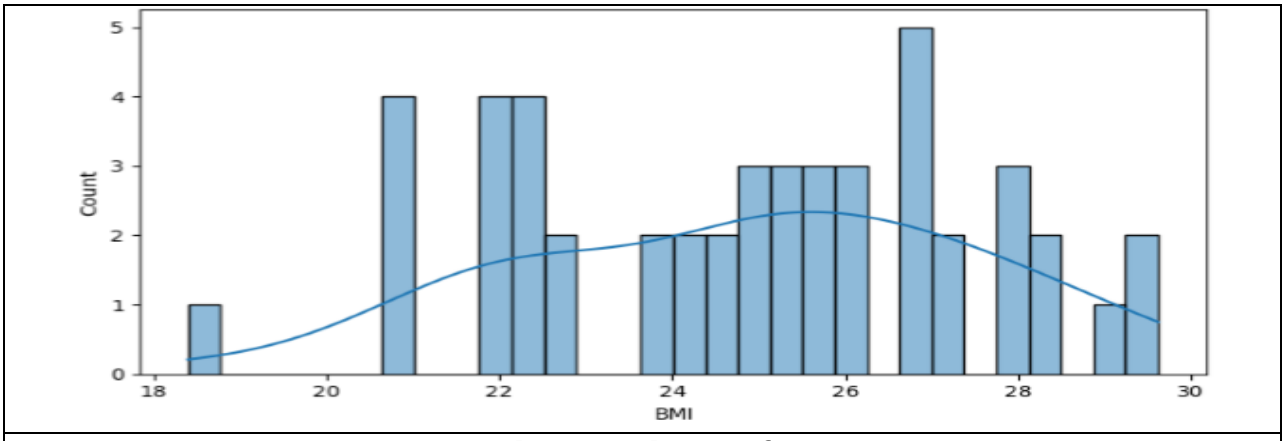
Parameters Analysed
Antenatal BMI, pre- and post-operative hemoglobin, numbers of fully soaked gauzes and pads, and Infant birth weight were noted, tabulated, and analyzed. The blood ooze from the surgical sites were focused rather than total blood loss to reduce errors.

RESULTS
AGE DISTRIBUTION- The age of patients ranged from 18 to 37 years, and around 10 patients were in the 28-29 years of age range.



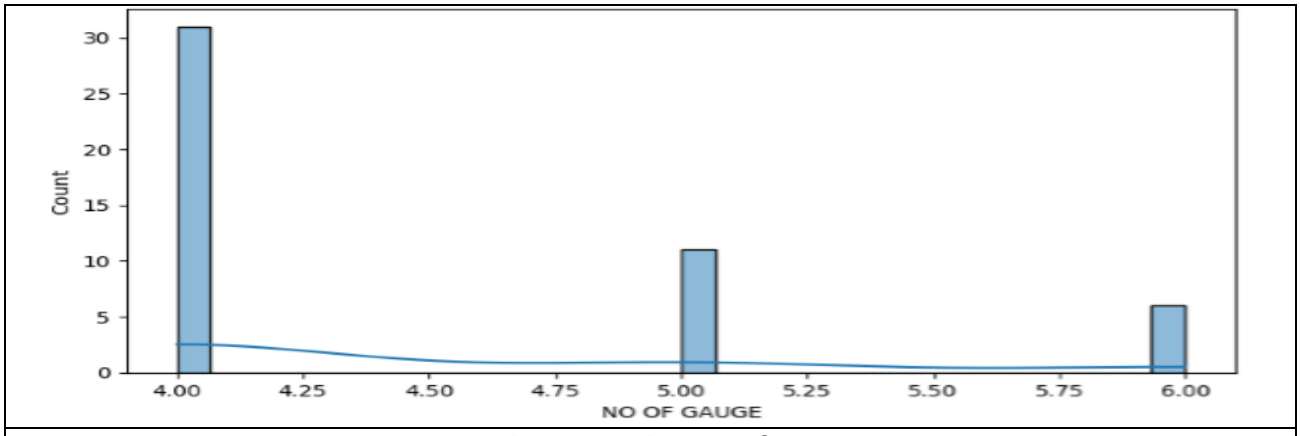
Graph 1: Distribution of Age

BMI DISTRIBUTION- BMI of the study group ranged from 18.5 to 29.6.
7 patients were around BMI of 27-28, and 14 were around 21-23.



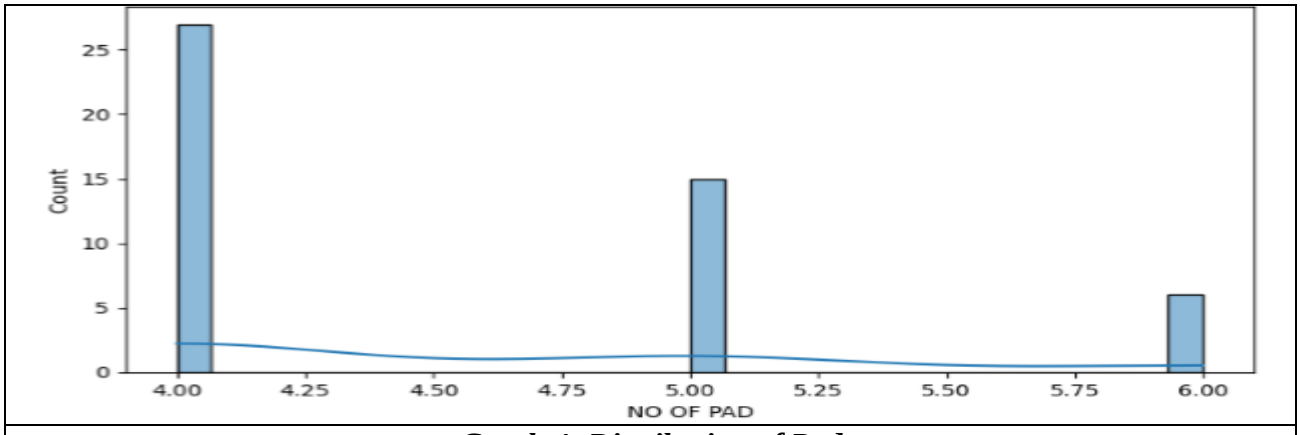
Graph 2: Distribution of BMI

Number of Soaked Gauzes- Ranged from 4 to 6, denoting a blood loss of 40 to 60 ml (the dry weight of the gauze being 10 grams).

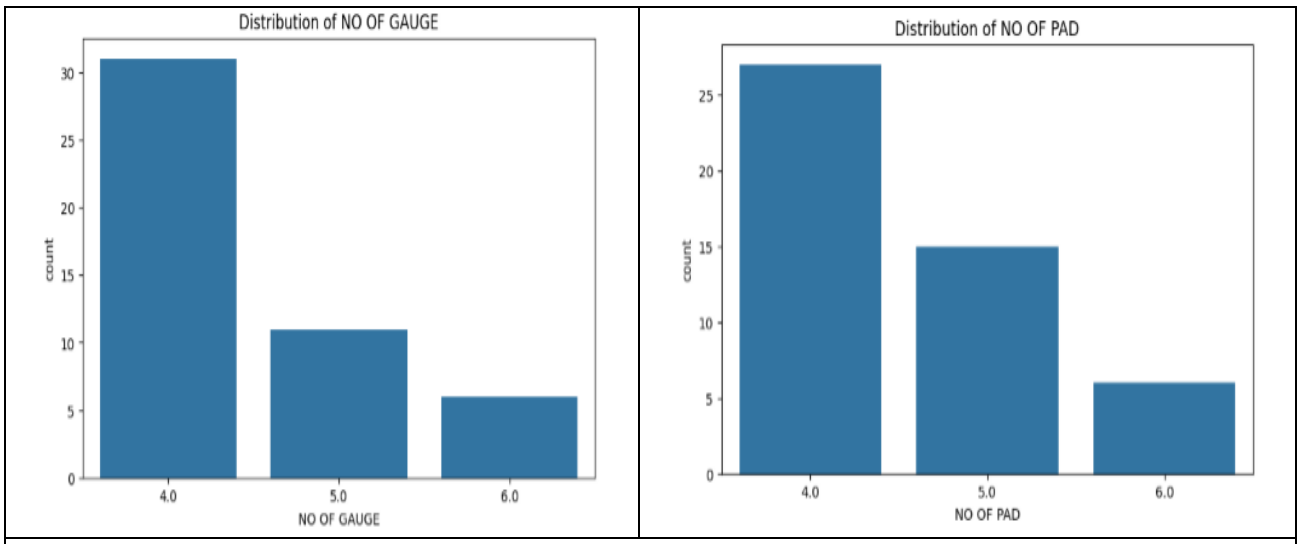


Graph 3: Distribution of Gauge

Number of Soaked Pads- ranged from 4 to 6, with more than 25 patients having a blood loss of 120 ml as dry weight of one pad was 30 grams.

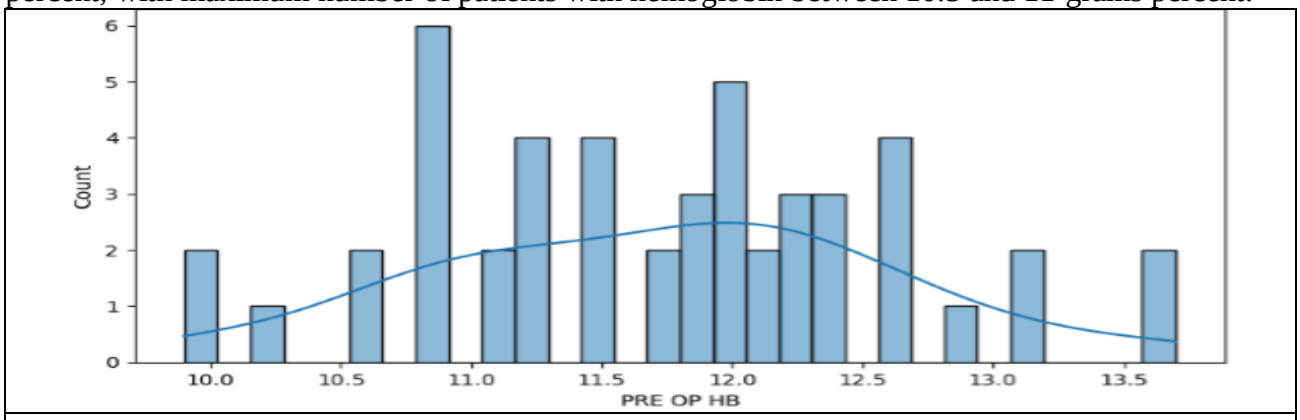


Graph 4: Distribution of Pad



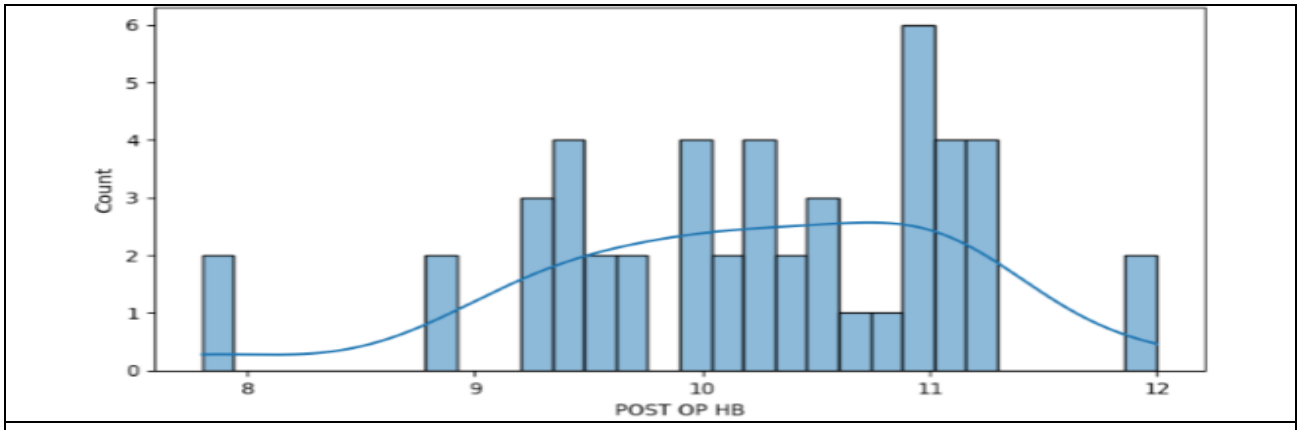
Graph 5: Distribution of Gauge and Pads

Pre-Operative Hemoglobin- ranged from slightly less than 10 grams percent to 13.6 grams percent, with maximum number of patients with hemoglobin between 10.5 and 11 grams percent.

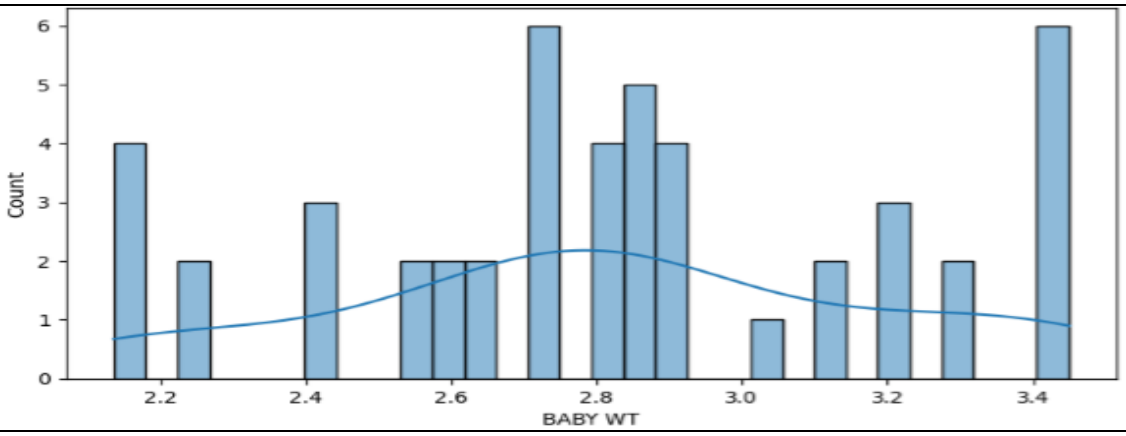


Graph 6: Distribution of Pre op HB

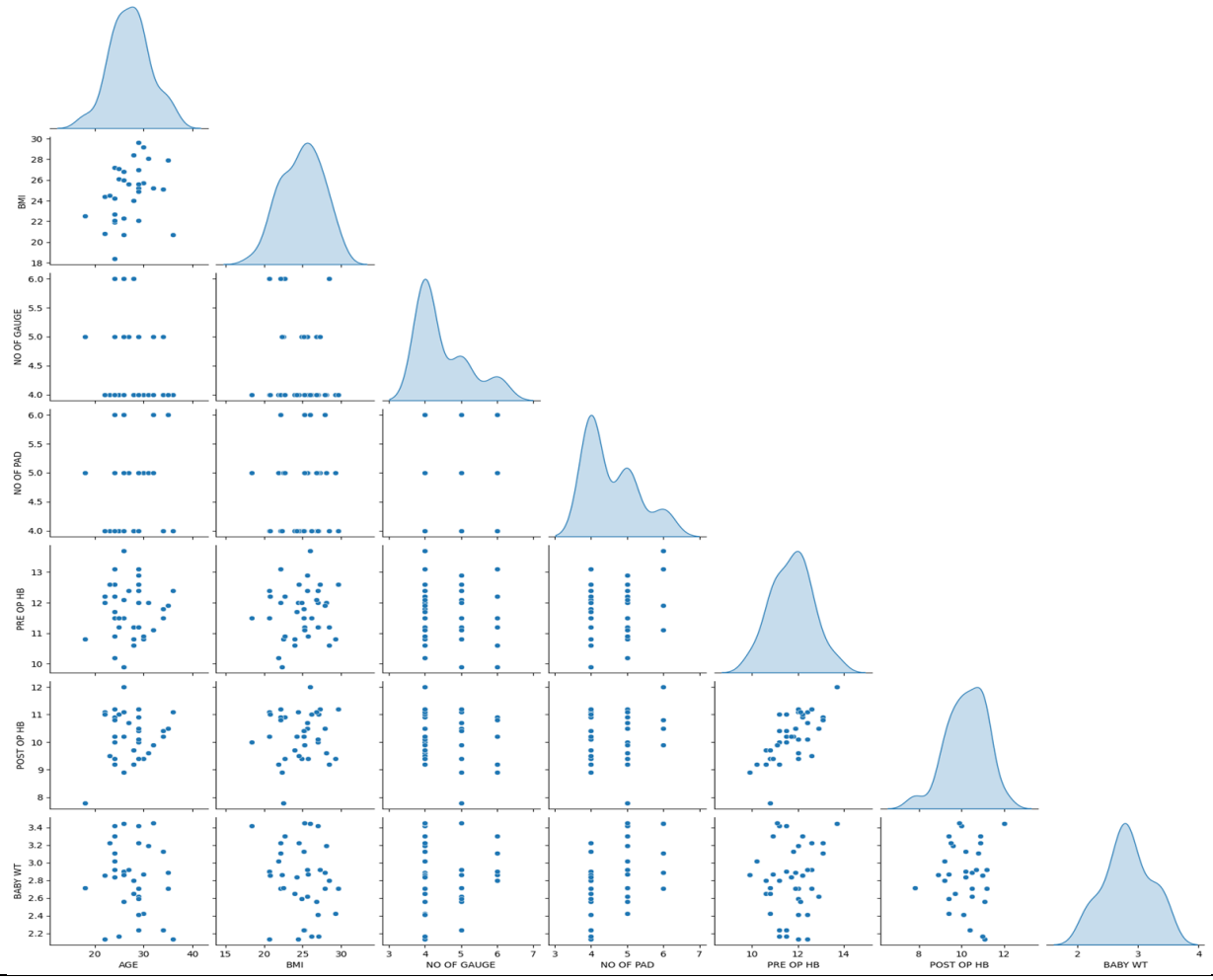
Post-Operative Hemoglobin- ranged from 7.8 to 11.1 grams percent.
The average drop in hemoglobin was between 1.4 to 1.6 grams percent.



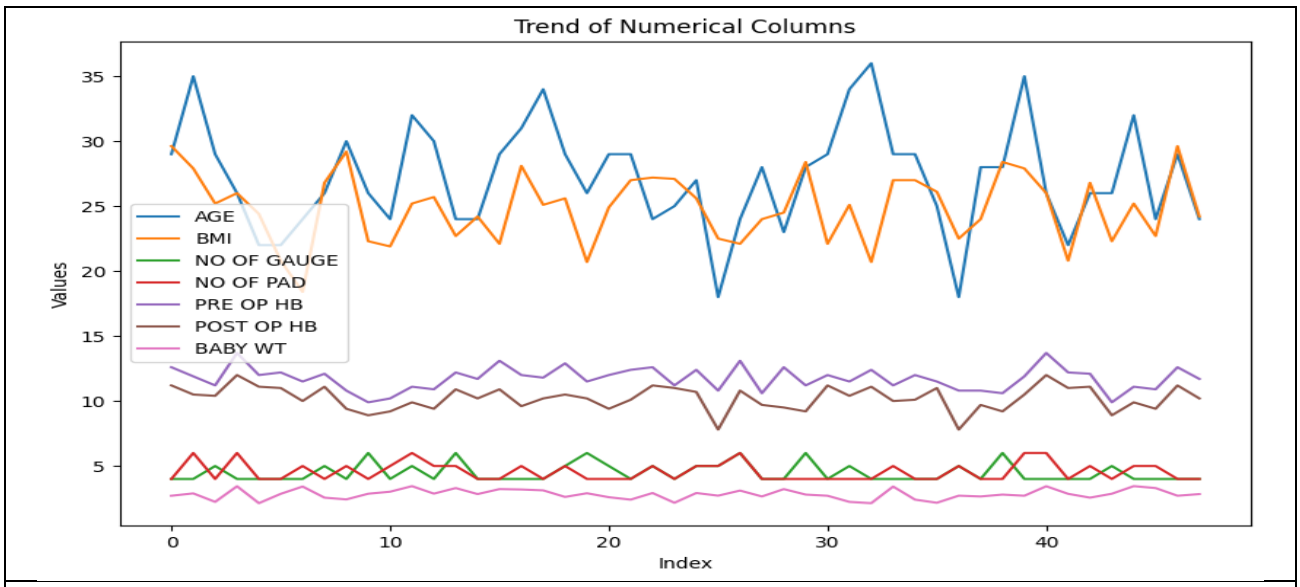
Graph 7: Distribution of Post OP HB



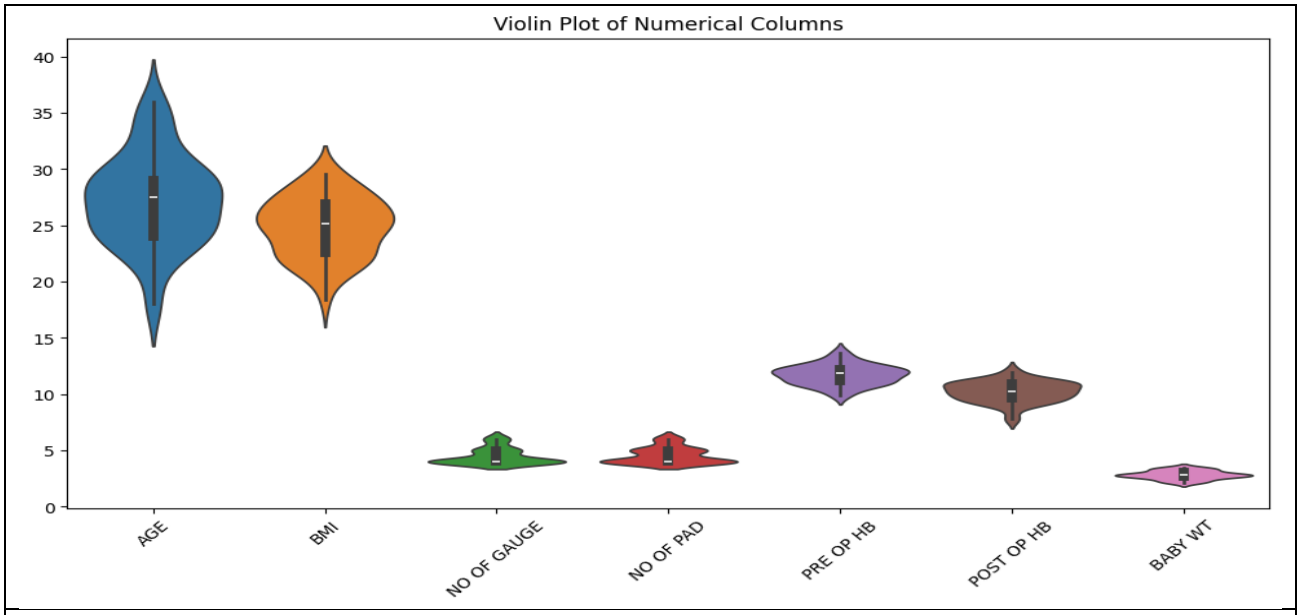
Graph 8: Distribution of Baby Wt.



Graph 9: Distribution of Age, BMI, Gauge, Pad, Pre op HB, Post OP HB, Baby Wt.



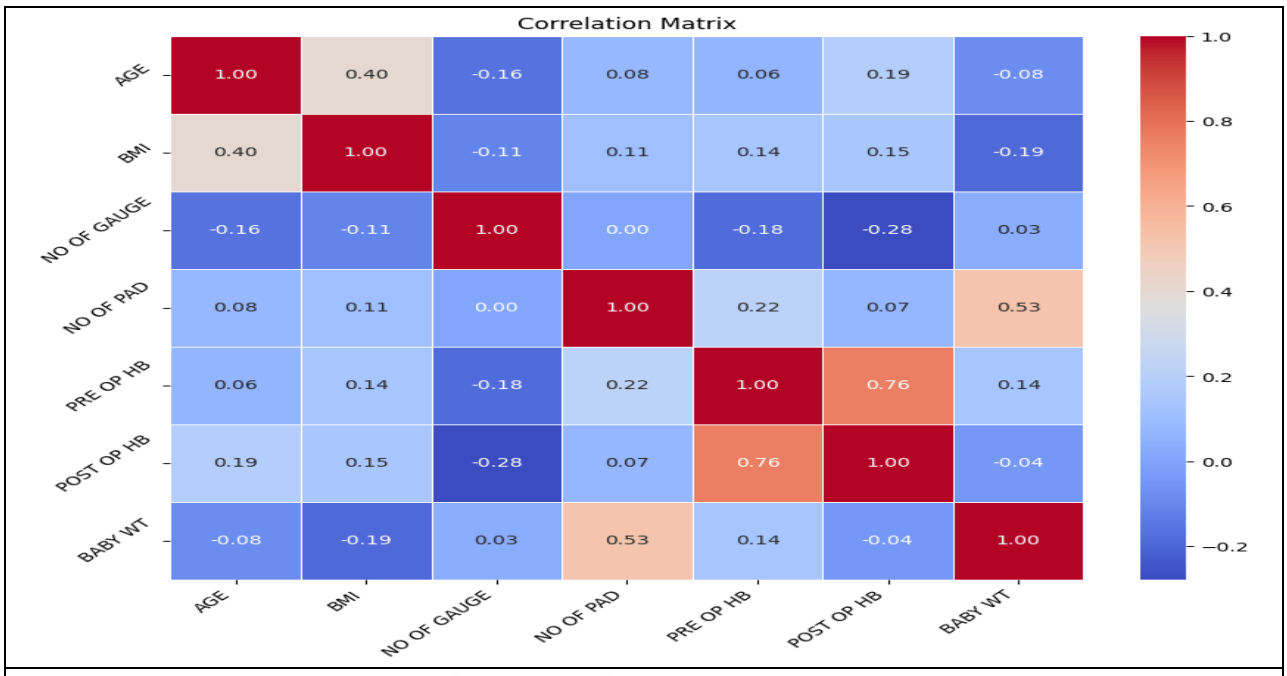
Graph 10: Trend of Numerical Columns



Graph 11: Violin Plot of Numerical Columns

Correlation Matrix

As for the correlation matrix drawn between the parameters, the drop in hemoglobin that is the r-value between pre and post-operative hemoglobin was 0.76, and the number of soaked pads with Infant birth weight showed an 'r' value of 0.53, which is not very significant. BMI had no correlation with blood loss or infant birth weight in this study group. The trend of numerical columns was represented as a color graph, which showed parallel trends of pre- and post-operative hemoglobin. The violin plot of the numerical columns shows the distribution of the pattern of each parameter taken up for the study described.



Graph 12: Correlation Matrix Diagram

DISCUSSION

Coagulation Pathway

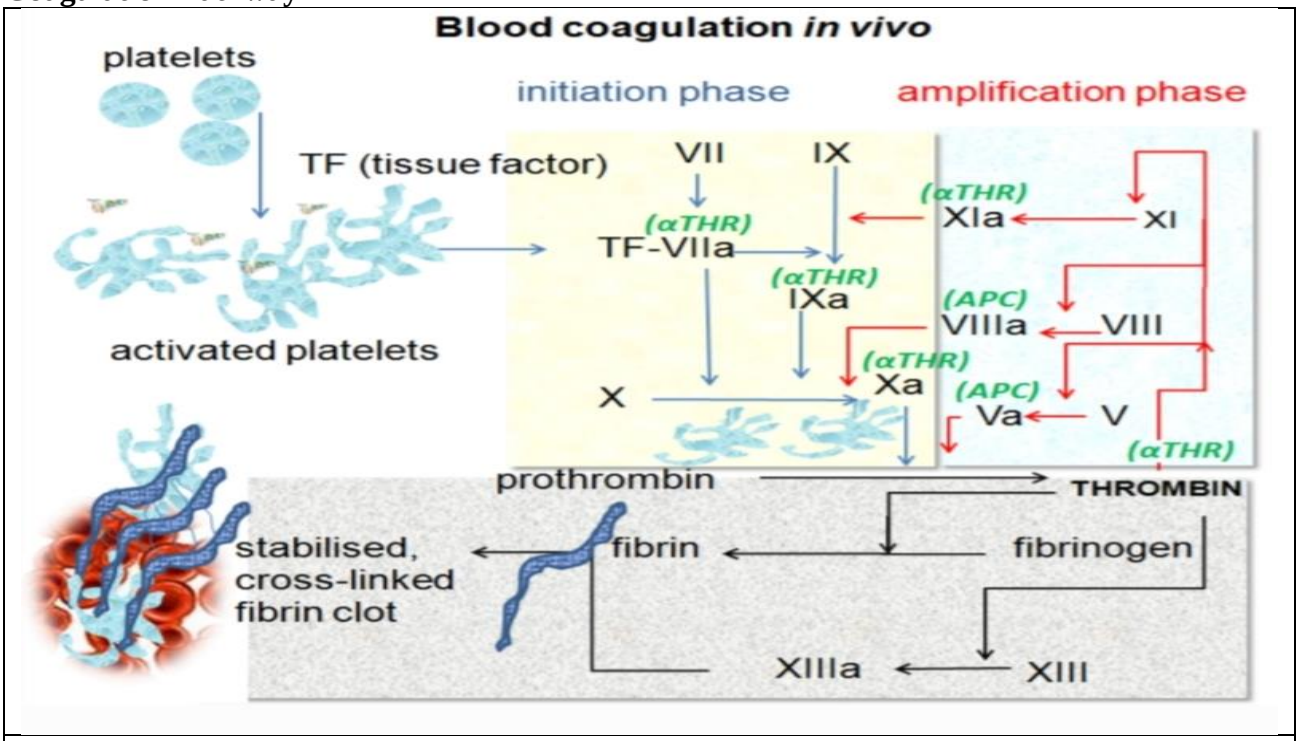


Image 1: Blood Coagulation in Vivo

Fibrinolysis Pathway

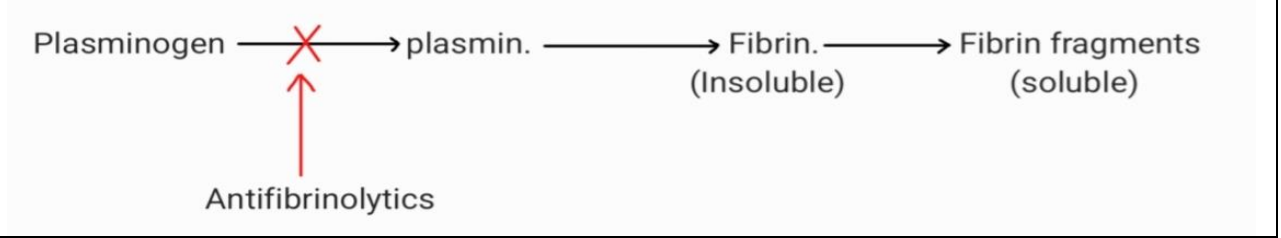


Image 2: Fibrinolysis pathway

The role of tranexamic acid in reducing blood loss during urological surgeries, orthopedic surgeries, and trauma has been well investigated. Surgical or mechanical trauma, mainly to venous plexus, leads to activation of the fibrinolytic system. This appears to be the major contributor of blood loss in those surgeries.[5]

The role of tranexamic acid in oral and parenteral forms up to a dose of 3 grams has been used, and the need for blood transfusion and blood required to be transfused have been studied especially in postnatal surgeries. Perioperative blood loss is a crucial parameter, often related to the underlying pathology and physiological changes in the patient, as in pregnancy.

Strategies to reduce bleeding carry a vital role in maternal and fetal well-being, and detection and correction of postnatal anemia in the mother.

Poor handling of anemia correction leads to depressed immunity, sepsis, wound healing issues, and affects social and domestic life events in the postnatal/postoperative period.

Blood loss during C section includes tissue dissection loss, vascular bleed, liquor, placental separation bleed and from disconnected umbilical cord.

Thus potential inaccuracies in calculating blood loss could occur due to liquor and placenta.

The assessment of change in hemoglobin might be more accurate method of evaluating peri operative blood loss. This is because the change in hemoglobin levels are measured solely based on the amount of blood lost and not on the other fluids namely suctioned liquor.

Studies relating to use of tranexemic acid for transurethral resection of prostate even indicated a reduction in operating time due to surgical bleed enabling faster resection of gland.

Tranexamic Acid

Tranexamic acid belongs to Anti fibrinolytic drugs. These are drugs which inhibit plasminogen activation and dislocation of clot, and are used to check fibrinolysis associated bleeding.

Antifibrinolytic Drugs

EACA (Epsilon Amino Caproic acid)

Tranexamic Acid

Epsilon Amino Caproic Acid: It is a lysin analogue that combines with lysin binding site of plasminogen and plasmin

Action of EACA

Specific antidote for fibrinolytic agent.

Primary Indication

- To counteract the effect of fibrinolytic drugs and bleeding.
- In hemophlias, adds adjunctive value by controlling bleeding in trauma, tooth extraction and other surgical procedures.

EACA usage: Orally, IV
Excreted by: Kidney

Side effects / Adverse drug reaction

- Hypotension, bradycardia, arrhythmias in case of rapid IV infusion.
- Ureteric obstruction when renal function is impaired.[6,7]
- Myopathy

EACA Limitations

- Required in large doses, hence tranexemic acid is more preferred.
- Dose: 5gm oral/ IV stat, followed by 1gm hourly till bleeding stops. Max – 30gms in 24 hrs.

- TRANEXAMIC ACID:
- Similar to EACA, a synthetic analogue of amino acid Lysin.
- IUPAC name: Trans 4 (aminomethyl) cyclohexanecarboxylic acid.
- Prior availability – 34 %
- Elimination half-life – 3-1hr
- Half-life – 2-11hrs
- Duration of action -3hrs after initial dose, 7 times more potent than EACA.
- Only FDA approved usage of TXA is for:
- Heavy menstrual bleeding.
- Short term prevention in hemophilic patients.

Mechanism of Action
- Synthetic reversible competitive inhibitorto lysin receptors found in plasminogen, preventing plasmin from binding the fibrin matrix.
- Excreted in kidney (95% in urine)

Administration[8]
- IV uses for hemorrhagic shocks, including PPH and trauma patients.
- Adult dose: 1gm bolus in 100 ml NS over 10 minutes (slow IV push).
- May repeat 1g dose over next 8hrs, not to exceed total 2gms.
- In elective C section: IV TXA 1gm over 5mins at least 10mins before skin incision.
- In bleeding associated with cervical conisation g IV during procedure followed by 1gm oral 3 TDS for 14 days or 1.5gm every 8hrs after procedure for 12 days.

Oral Uses
- Oral TXA for cyclic TMB 300 mg + 10 for upto 5 days during menstruation.

Other Uses
- Cardiopulmonary bypass surgery.
- Tonsillectomy, prostate surgery.
- Menorrhagia especially due to IUCD.
- Recurrent epistaxis.

Contraindictations
- Known allergy
- Intracranial bleeding
- Known defective colour vision
- H/O venous or arterial thromboembolism/ active thromboembolic disease.

Caution
- In renal function impaired patients.
- No adjustments regarding hepatic function impaired patients.
- TXA is pregnancy category drug.
- Exposure to infant via breast milk.

Side effects
- Nausea and diarrhea.
- Thromboembolic events.
- Disturbed colour vision.
- Thrombophlebitis in the injected vein.

EACA and TXA are lysine analogues that compete for lysine binding sites on plasminogen and plasmin, thereby blocking their interaction with fibrin.
Tranexamic acid is given intravenously in trauma resuscitation and in patients with massive hemorrhage. Intraoperative bleeding in hip, knee arthroplasty and cardiac surgery are also medications.
70% excreted in urine.
Antifibrinolytic drugs inhibit plasminogen activation and dissolution of clot. Epsilon aminocaproic acid and tranexamic acid are lysine analogues that compete for lysine- binding sites on plasminogen and plasmin, thereby blocking their interaction with fibrin
Oral Tranexamic acid tablets upto 3gm to reduce surgical bleed in major orthopedic surgeries such as fixation of fracture of neck of femur and prostate resections.
As tranexemic acid being an anti-fibrinolytic agent could effectively stabilize small unorganized clots in a tissue factor inductor prone surgeries which could create considerable raw area and bleeding, we intend to standardize the dose of Tranexamic acid as 500 in 100 ML normal saline along with induction of regional anesthesia.
Review of literature mentions 500 to 1500 ml of blood loss in C section and surgical ooze itself contributed to 20-30% of blood loss, use of tranexemic acid has definitive reduction at this surgical ooze limiting it to 120 ml.
This advantage could be useful in anemic and high risk obstetric patients who are prone for significant morbidity even to mild or moderate blood loss.
A chronically anemic patient tensed to have increased ooze on moderate surgical dissection. The physiological response of hypoxic vasoconstriction could occur in the tissues due to diminished oxygen supply subsequent to reduced oxygen carrying capacity in the event of reduced hemoglobin. This response diverts away blood to adjacent areas of microvasculature where tissues have overcome the tissue injury and edema, response to surgical handling.
There may also be an altered physiological response causing diffuse ooze in the surgical field and tendency for unstabilized micro clots. Tranexamic acid serves as a excellent rescue in preventing the dissolution of fibrin and maintaining a subtle and good surgical field, reduce micro ooze and improve wound healing. Studies have proved that beneficial role of tranexemic acid when given prophylatically in such patients allows good wound healing, reduce blood loss and reducing requirement of blood transfusion and related complications.
The patient presenting for a repeat C section have a scar right from the skin to the uterine surface which could have healed by fibroblast proliferation and neo vascularisation in various directions within the layers of abdomen leading to adhesions from a subcutaneous plane to urinary bladder and uterine layers.
This study was aimed to note and prove the reduce of surgical ooze even in those of 500 mg of tranexemic acid given prophylatically just along with induction of anesthesia namely subarachnoid block with nil hemodynamic changes thus proving maternal and fetal safety along with prevention of morbidity.

CONCLUSION

The use of tranexemic acid has been well documented as one of the strategies to reduce blood loss in both surgical procedure as well as obstetric hemorrhage. The use of the anti fibriolytic agent along with induction appears to be safe and effective in reducing blood loss due to surgical dissection against the well documented surgical ooze of more than 200 – 250 ml, especially in previous C- sections without use of tranexemic acid.
Use of tranexemic acid in a dose of 500 mg as shown almost 50% reduction in blood loss in repeat C- section. Hence the use of this drug maybe recommended towards regular usage during beginning of anaesthesia in repeat C-section. Step up of dose is suggested in patient with risk of profound hemorrhage such as due to uterine atony.
A parallel trend between pre-operative and post-operative hemoglobin levels suggest that the drop is same, small and consistent irrespective of BMI, and volume of liquor and that in the suction bottle.

However larger studies are needed to substantiate the findings.
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