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COMPARISON OF PERIOPERATIVE CHANGES IN HEMOSTATIC POTENTIAL WITH LOW-FREQUENCY PIEZOELECTRIC THROMBOELASTOGRAPHY (LPTEG) IN PATIENTS WITH BENIGN PROSTATIC HYPERPLASIA DURING RADICAL RETROPUBIC PROSTATECTOMY

Suslov O.S.

Odessa National Medical University

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ПОРІВНЯННЯ ПЕРІОПЕРАЦІЙНИХ ЗМІН ГЕМОСТАТИЧНОГО ПОТЕНЦІАЛУ ЗА ДОПОМОГОЮ НИЗЬКОЧАСТОТНОЇ П'ЄЗОЕЛЕКТРИЧНОЇ ТРОМБОЕЛАСТОГРАФІЇ (НПТЕГ) У ПАЦІЄНТІВ З ДОБРОЯКІСНОЮ ГІПЕРПЛАЗІЄЮ ПРОСТАТИ ПІД ЧАС ЧЕРЕЗМІХУРОВОЇ РАДИКАЛЬНОЇ ПРОСТАТЕКТОМІЇ

Суслов О.С.

Мета. Порівняти періопераційні зміни у НПТЕГ пацієнтів, котрим проводилася операція відкритої черезміхурової радикальної простатектомії (ЧРПЕ) з приводу доброякісної гіперплазії простати (ДГПЗ), під загальною або епідуральною методикою анестезії.

Матеріали та методи. Проспективно оцінювалися дані пацієнтів (n=69) з діагнозом ДГПЗ (підтвердженим гістологічно та рівнем PSA), котрим проводилося оперативне втручання у обсязі ЧРПЕ у період з листопаду 2017 р. по листопад 2019 р. на базі Одеської обласної клінічної лікарні. Пацієнти були розподілені на дві групи: групу А (n=33) склали пацієнти, що проходили ЧРПЕ з використанням епідуральної анестезії (ЕДА) через катетер; групу В (n=36) – ЧРПЕ з використанням загального наркозу та внутрішньовенної анальгезії опіоідами. Усім учасникам проведено дослідження гемостатичного потенціалу за допомогою НПТЕГ при надходженні до лікарні перед проведенням будь-якої терапії, безпосередньо перед оперативним втручанням та на 60 хвилині оперативного втручання. Статистична обробка отриманих даних проводилася за допомогою програмного забезпечення MATLAB.

Результати. Вихідні данні перед операцією у пацієнтів обох груп демонстрували компенсований гіперкоагуляційний стан та співпадали з такими на момент надходження. Однак дані на 60 хвилині у групі А демонструють тромбоеластограму, котра тотожна нормальній; у групі В чітко відображені порушення агрегації при нормальних показниках коагуляції та фібрінолізу. Відмінності були статистично значущими (P <0,0001).

Висновок. При компенсованому гіперкоагуляційному розладі, котрий реєструється у пацієнтів з ДГПЗ що потребують ЧРПЕ, під час оперативного втручання з використанням ЕДА через катетер значення НПТЕГ тотожні нормі. В той самий час, дані НПТЕГ при ЧРПЕ з використанням загальної анестезії та внутрішньовенною анальгезією опіоідами демонструють гіпоагрегантний стан при нормальних показниках гемокоагуляції та фібрінолізу. Причинами

вищевказаного можуть бути сприятлива дія епідуральної анестезії на симпатичну нервову систему, а також зменшення потреби у введенні інфузійних розчинів при ЕДА через менші показники крововтрати. Однак, необхідні подальші дослідження серед пацієнтів урологічного профілю для підтвердження цих результатів та можливості їх інтерпретації для всієї когорти урологічних пацієнтів.

Ключові слова: доброякісна гіперплазія передміхурової залози, хірургія, черезміхурова простатектомія, анестезія, епідуральна анестезія, НПТЕГ

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Suslov O.S.

Objectives. To compare perioperative changes in LPTEG of patients undergoing open radical retropubic prostatectomy (ORRP) surgery for benign prostatic hyperplasia (BPH), under general or epidural anesthesia.

Materials and methods. The data of patients (n = 69) diagnosed with BPH (confirmed histologically and by PSA level), who underwent surgery for ORRP in the period from November 2017 to November 2019 at the Odessa Regional Clinical Hospital, were prospectively evaluated. Patients were divided into two groups: group A (n = 33) consisted of patients undergoing ORRP using epidural anesthesia (EDA) through a catheter; group B (n = 36) - ORRP using general anesthesia and intravenous opioid analgesia. All participants were tested for hemostatic potential using LPTEG upon admission to the hospital prior to any therapy, immediately before surgery, and at 60 minutes of surgery. Statistical processing of the obtained data was performed using MATLAB software.

Results. The baseline data before surgery in patients in both groups demonstrated a compensated hypercoagulable state and coincided with those at the time of admission. However, data at 60 minutes in Group A show a thromboelastogram that is identical to normal; Group B clearly reflects aggregation disorders with normal coagulation and fibrinolysis. The differences were statistically significant ($P < 0.0001$).

Conclusion. In compensated hypercoagulative disorder, which is registered in patients with BPH who require ORRP, during surgery with EDA through the catheter, the values of LPTEG are identical to the norm. At the same time, the LTPEG data for ORRP using general anesthesia and intravenous opioid analgesia show a hypoaggregative state with normal hemocoagulation and fibrinolysis rates. The reasons for the above may be the favorable effect of epidural anesthesia on the sympathetic nervous system, as well as reducing the need for the introduction of infusion solutions for EDA due to a comparatively lower level of the blood loss. However, further studies are needed among urological patients to confirm these results and to interpret them for the entire cohort of urological patients.

Keywords: benign prostatic hyperplasia, surgery, radical retropubic prostatectomy, anesthesia, epidural anesthesia, LPTEG

Introduction

The choice of the best anesthesia method for urological surgery to reduce the duration of inpatient treatment remains controversial[1,2]. For many years, anesthetists have discussed how a type of anesthetic can act on haemostasis.

It is well known, that neuroaxial anaesthesia has some physiological effects that are absent with other methods of anaesthesia and may improve outcomes. One of the main disputable questions is the action of epidural anaesthesia on haemocoagulation system[3].

During my literature search, I've made a conclusion that the limited data about haemocoagulation status present for patients with benign prostatic hyperplasia during their treatment. The most attention to haemostasis is given to patients with malignant processes in urology.

In previous researches of patients with benign prostatic hyperplasia, data were demonstrated changes in the base level of haemostatic equality to mild hypercoagulation, compensated by hyperfibrinolysis[4].

The objective of this study is to compare perioperative changes in LPTEG of patients undergoing open radical retropubic prostatectomy (ORRP) surgery for benign prostatic hyperplasia (BPH) under general or epidural anesthesia.

Materials and methods

The data of patients (n = 69) diagnosed with BPH (confirmed histologically and by PSA level), who underwent surgery for ORRP in the period from November 2017 to November 2019 at the Odessa Regional Clinical Hospital, were prospectively evaluated. The inclusion criteria were: age 70±10 years; histologically confirmed diagnosis of benign prostatic hyperplasia; PSA levels less than 5 ng/mL; the giant mass of the tumor that requires open radical retropubic prostatectomy. The exclusion criteria were: need in any of antithrombotic/anticoagulant treatment; any urgent pathology that developed during treatment, is not a complication of treatment and must be primarily treated; any conditions, that requier additional treatment to standard institutional protocol; patient refusal in participation on any of the stage of the studying.

Patients were divided into two groups: group A (n = 33) consisted of patients undergoing ORRP using epidural anesthesia (EDA) through a catheter. Hereby, I'll describe how epidural was performed for those patients.

Epidural Technique

An 18-gauge epidural needle was inserted at the L 1-2 interspace using the loss-of-resistance technique with the patient in the sitting position in the holding area. The epidural catheter was inserted and subsequently tested for subarachnoid or intravascular placement using 3 ml lidocaine, 2%, which is standard practice at our hospital. A bolus dose of 6–8 ml bupivacaine, 0.5%, was subsequently injected, and a loss of sensation to cold was determined after 15 min. If a sensory block up to the Th 8-9 dermatomal level was achieved, the patient was considered to be ready for surgery. If not, a further dose of 2–3 ml bupivacaine, 0.5%, was injected epidurally. If this did not achieve the desired block, it was assumed that the catheter was incorrectly placed, and the patient was offered the choice of one more attempt at epidural catheter placement or exclusion from the study.

Group B (n = 36) - ORRP using general anesthesia and intravenous opioid analgesia. Hereby, I'll describe how general anaesthesia was performed for those patients.

General anaesthesia technique

Anaesthesia was induced with 1–2 mg/kg propofol; 2 мg/kg fentanyl was given as an analgesic before induction of anesthesia, and 0.5 mg/kg rocuronium was used as a muscle relaxant for intubation. After tracheal intubation, the patients were ventilated with 33% oxygen using volume-controlled ventilation with the maintenance of anaesthesia by constant infusion of propofol 6-8 mg/kg per hour. Monitoring included indirect, noninvasive blood pressure and heart frequency, oxygen saturation and end-tidal concentration of carbon dioxide. Perioperative analgesia was maintained using a constant infusion of fentanyl 0.1-0.2 мg/kg per minute to all patients. Hypotension was treated with volume replacement. Bradycardia (heart frequency < 50 beats/min) was treated with 0.5 mg atropine if needed. Intravenous fluids were administered to maintain adequate blood pressure and basal fluid requirement, and colloids were administered when deemed necessary by the attending anesthesiologist. When spontaneous respiration had returned and the patient was able to open his eyes on command, the trachea was extubated, and the patient was transferred to the postoperative ward.

All participants were tested for hemostatic potential using LPTEG upon admission to the hospital prior to any therapy, immediately before surgery, and at 60 minutes of surgery. Blood sampling for the study was performed under the same conditions according to the standard method from the cubital vein of the patients. To study the system of hemostasis and rheological properties of blood, hardware and software complex ARP-01M «Mednord» was used for continuous registration of the basic parameters of the process of blood clot formation and it's lysis.

The referent data of healthy volunteers and a brief explanation of the meaning of measurable value are presented in **Table 1.**

Table 1. The referent data of LPTEG of healthy volunteers

Indicator	Level
A0, rel.units, initial index of blood aggregation state	222.25±15.33
R(t1), min., time of the contact phase of coagulation	2.36±0.34
ICC, rel.units, the intensity of the contact phase of coagulation	84.3±10.91
CTA, rel.units, constant of thrombin activity	15.22±3.46
BCT (t3), min., Blood Clotting Time	8.42±1.68
ICD, rel.units, the intensity of coagulation drive	21.15±3.70
ICP, rel.units, the intensity of clot polymerization	14.45±1.4
MA, rel.unit, maximal clot density (amplitude)	525.45±60.50
IRCL, %, the intensity of retraction and clot lysis	16.45±1.40

Statistical processing of the obtained data was performed using MATLAB software.

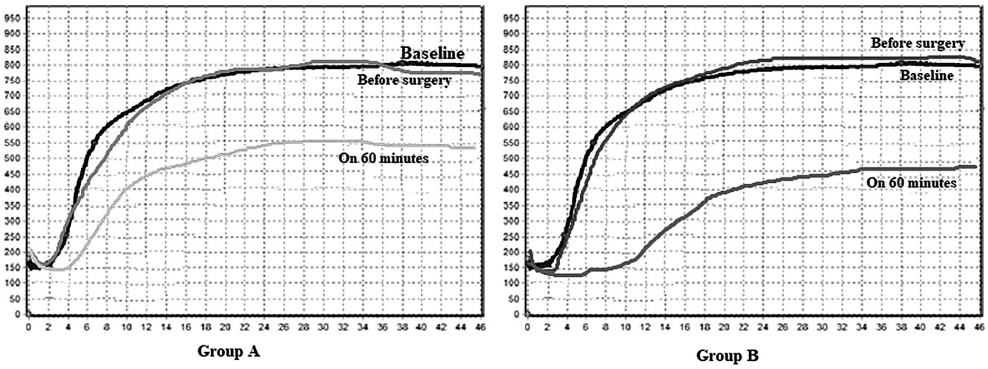
Results

All the results presented in **Table 2** of this publication. Graphical representation of the mean values for each group could be found in **Picture 1.**

The baseline data before surgery in patients in both groups demonstrated a compensated hypercoagulable state and coincided with those at the time of admission. Those data were discussed previously in my researches, and are typical for this cohort of urological patients[4].

Table 2. LPTEG results for groups on admission, right before the surgical treatment and at 60 minutes of surgical intervention

	Level					
	On admission		Before surgery		At 60 minutes of surgery	
Indicator	Group A	Group B	Group A	Group B	Group A	Group B
A0	222.25±15.33	219.45±14.31	221.25±14.33	220.39±13.91	206.15±11.31	168.01±13.91
R(t1)	2.15±0.12	2.19±0.28	2.16±0.22	2.16±0.31	2.31±0.18	5.37±0.75
ICC	97.62±18.72	98.22±17.41	97.29±18.12	97.24±17.01	87.1±9.87	63.24±13.01
CTA	15.22±3.46	14.98±3.41	15.32±3.16	15.01±3.61	16.32±2.97	10.01±3.01
BCT(t3)	8.42±1.68	8.41±1.66	8.49±1.41	8.43±1.19	8.69±1.04	11.23±1.24
ICD	43.67±4.11	42.57±4.23	43.77±3.05	43.57±4.09	24.11±2.23	48.07±4.11
ICP	21.12±1.01	21.34±1.07	20.12±1.16	20.41±1.13	15.22±1.11	26.39±1.47
MA	569.21±71.32	568.59±70.11	564.66±72.88	563.91±68.38	521.56±58.13	434.98±72.11
IRCL	72.02±2.01	71.91±2.03	72.32±2.56	72.41±2.38	17.01±1.02	7.31±1.21



Picture 1. Graphical representation of LPTEG data of Group A and Group B.

However, data at 60 minutes in Group A show a thromboelastogram that is identical to normal; Group B clearly reflects aggregation disorders with normal coagulation and fibrinolysis. All those changes are present in The differences were statistically significant (P <0.0001).

Conclusion

In compensated hypercoagulative disorder, which is registered in patients with BPH who require ORRP, during surgery with EDA through the catheter, the values of LPTEG are identical to the norm. At the same time, the LTPEG data for ORRP using general anesthesia and intravenous opioid analgesia show a hypoaggregative state with normal hemocoagulation and fibrinolysis rates. The reasons for the above may be the favorable effect of epidural anesthesia on the sympathetic nervous system, as well as reducing the need for the introduction of infusion solutions for EDA due to a comparatively lower level of the blood loss. However, further studies are needed among urological patients to confirm these results and to interpret them for the entire cohort of urological patients.

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