Effect of Anesthesia on the Changes in the Hormones Levels During and After Transvesical Prostatectomy

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Introduction: Hypovolemia and pain are direct stimulators of hormonal response to trauma. Thus, neuroendocrine, metabolic and inflammatory aspects of the injury are part of an overall "stress response". In particular, it manifests in patients undergoing surgical intervention. These reactions can occur with trauma, burns, severe infections and physical exertion. Metabolic and neuroendocrine response to surgical intervention depends on several factors, such as severity and duration of the surgical trauma, patient’s age, type of anesthesia and surgical techniques. Goal: The aim of this study was to determine and evaluate levels of hormones in patients undergoing transvesical prostatectomy under general or local anesthesia: ACTH, PRL, TSH, T3, T4, cortisol, and to determine the influence of consciousness (in local-regional anesthesia) in relation to the unconscious state in the general balanced anesthesia on hormonal response measured values above mentioned levels of hormones. Determined the level of hormone values during three time periods: before anesthesia, during surgery in enucleation of prostate glandular tissue and 24 hours after surgery. Patients and methods: The study included a total of 100 patients from the Clinic of Urology, Clinical Center of Sarajevo who underwent surgery by technique of transvesical prostatectomy. According to the criteria defined the subjects were divided into two test groups: Group I (n=50) - patients underwent surgery under general anesthesia, Group II (n=50) - patients underwent surgery in local-regional anesthesia. The first blood sample was taken at screening purposes just before the introduction of general anesthesia or loco regional anesthesia. The second sample was taken during surgery during enucleation of prostate gland tissue. A third blood sample was taken 24 hours after surgery. Results: Increased levels of ACTH intraoperative in both anesthesia techniques applied, with a slightly larger increase in the value of the respondents with technique of general anesthesia. The values of ACTH after 24 hours showed a return to preoperative values in case of both techniques of anesthesia. Increased levels of PRL intraoperative in both anesthesia techniques applied, with larger peak values registered in patients under technique of general anesthesia (3554μIJ/L). High levels of PRL are maintained and postoperatively after 24 hours with both techniques applied anesthesia. Increased intraoperative levels of TSH in both anesthetic techniques, with higher maximum values in patients with technique of general anesthesia (7.20 mU/L). The values of TSH postoperatively after 24 hours showed a return to baseline in case of both applied technique of anesthesia. Low intraoperative values of T3 in both anesthetic techniques. Lower values of T3 are still continuing after 24 hours postoperatively in both applied techniques of anesthesia. The values of T4 hormone in subjects under general anesthesia did not show major deviations intraoperatively or postoperatively. Conclusions: Regional anesthesia with the present consciousness, but with sympathetic blockade caused a greater suppression of hormonal responses, than the general balanced anesthesia. Key words: General anesthesia, Regional anesthesia, Hormone levels, Transvesical prostatectomy.
lin, testosterone and estradiol). On the overall response to stress a major impact have vasoactive substances in the regulation of immune and inflammatory responses: a) cytokines (interleukins IL-1, IL-6, TNF, and interferon); b) kallikrein-kinin system; c) prostaglandins; d) serotonin e) histamine.

Some of them act on site of origin, locally, some on the same cells that secrete them, and some have endocrine effects. Cytokines play a key role in the regulation of immune responses by linking the endocrine, nervous and hematopoietic systems (3, 4). Kallikrein-kinin system is vasodilatation system that plays a role in inflammatory processes, controlling blood pressure, coagulation and pain. Prostaglandins are divided into groups, the most important is PGE which is a potent vasodilator at the level of microcirculation, participate in the inhibition of platelet aggregation and inhibition of proliferation of T and B lymphocytes. Serotonin is a neurotransmitter that is produced in the pituitary gland, platelets and the gastrointestinal tract and causes vasospasm and platelet aggregation in injured tissue. Histamine is a biogenic amine formed in basophilic leukocytes and mast cells. Increases capillary permeability for leukocytes that participate in the defense of the organism.

The sympathetic nervous system response to stress is the increase in cardiovascular resistance, cardiac output, arterial pressure and heart rate. Coming to a redistribution of blood flow and its centralization, to retain water and sodium with potassium and nitrogen excretion. Increased function of liver, kidney and pancreas, and glucagon from the pancreas induce gluconeogenesis, while conversely insulin to prevent gluconeogenesis. The most important factor that determines the extent of gluconeogenesis is the ratio of concentrations of glucagon and insulin. Glucagon will increase glycogenolysis, lipolysis and hepatic ketogenesis. Insulin increases glucose transport through the cell membrane, stimulates the production of glycogen, inhibits lipolysis, inhibits hepatic ketogenesis. It also increases amino acid transport and protein synthesis in muscle, adipose tissue and liver.

After all major surgeries there is an increase in plasma concentrations of glucagon. Intraoperative low values of both insulin and elevated levels of counter-insulin hormones are powerful stimulus for gluconeogenesis (5). Cortisol, glucagon and epinephrine exhibit a synergistic effect on gluconeogenesis, protein catabolism, glucose intolerance, insulin resistance and peripheral leukocytosis. Numerous studies have shown that the resulting response in the body is not only a consequence of the action of hormones, but that the endocrine and inflammatory mediators together create an active metabolic response to stress. Thus, neuroendocrine, metabolic and inflammatory aspects of the injury are part of an overall "stress response". In particular, it manifests in patients undergoing surgical intervention. These reactions can occur with trauma, burns, severe infections and physical exertion. Metabolic and neuroendocrine response to surgical intervention depends on several factors, such as severity and duration of the surgical trauma, patient's age, type of anesthesia and surgical techniques (6,7). A number of hormones in the broad sense, which is secreted during this period, affect change in hemodynamic stability, metabolism, immune response in the body and changes in internal milieu. The study was focused on the value of the ACTH hormone, prolactin, TSH, T3, T4, cortisol, during the two different techniques of anesthesia: general and local-regional, applied during surgery transvesical prostatectomy.

1.1. Endocrine and metabolic changes
Mediators of hormonal responses of the endocrine glands in the broad sense are called hormones. The extracted hormones, acting through the blood to target cells and the mode of communication in the body is called the endocrine path (8). Connections between cells are largely made through the endocrine, nervous and immune systems. Some hormones, like renin, which is produced in the kidney with its enzymatic activity to plasma proteins leads to the formation of the hormone angiotensin into the circulatory system (9). Others, such as testosterone in women, and dihydrotestosterone and estradiol in men, partly secreted, partly made inextricable in the same tissues where they are synthesized, and have an impact on the distal areas, while other chemical transmitters have only local effects (10).

The whole system of interaction between different cells of single tissue could not function without the intimate connection of the nervous system (neurocrine hormones) with other regulatory systems, and together build a neuroendocrine regulation. Pituitary-hypothalamic axis and the sympathetic nervous system are activated by sensory nerve stimuli, and somatic and autonomic, at sites of trauma or injury. Cathecolamines are released from the adrenal glands and their secretion (adrenaline, noradrenaline) through presynaptic nerve endings occurs in response to hypothalamic stimulation. Adrenal gland cortex secretes an entirely different group of hormones called corticosteroids (mineral corticoids, glucocorticoids, and small amounts of androgens hormones). Subsequent stimulation of aldosterone secretion from the adrenal cortex will lead to an increase in sodium reabsorption in the distal renal tubules. Aldosterone belongs to at least 95% of the total mineral corticoid activity of hormones that are secreted from the adrenal cortex (6, 9).

It is known that there is no direct functional link between the core (where are secreted adrenaline and noradrenaline) and adrenal cortex.

1.2. Influence of anesthetics for local-regional anesthesia on hormonal response
Influence of regional anesthesia on the "stress response" has been widely investigated. Spinal and epidural anesthesia can block the sympathetic stimulation caused by surgical incision, which leads to the release of catecholamines and other hormones. Inhibition is associated with the level of neural blockade, especially in surgery of the lower abdomen and
lower extremities (1). Removal of the hormonal response occurs only when, not only somatic afferent, but also, and autonomic afferent pathways are blocked by local anesthetics. Blockade of sympathetic nerves and consequent vasomotor loss of muscle tone causes changes in blood flow in various organs, depending on the level achieved by the block (1).

In individual studies, we believe that regional anesthesia reduces the incidence of pulmonary complications, and also relieves some of the cardiovascular responses to stress as a result of sympathetic activation (1), reduces intraoperative bleeding and the time spent in the hospital. If using this technique of anesthesia for transvesicular resection of the prostate, anesthesia is required up to Th 10. The usual dose of bupivacaine 0.5% for most patients is 3ml.

**Bupivacaine** and other local anesthetics from this group block sodium channels, and to a lesser extent inhibit the membrane permeability for potassium and calcium. Inhibition of depolarization by this anesthetic inhibits the formation and conduct impulses along nerve fibers and their endings. It belongs to the anesthetic, which achieves profound sensory and mild motor blockade, with a median duration of anesthesia for several hours (1), and without significant effect on the hormonal status (2). Also, research shows that it is not recorded the anesthetic effect on the levels of cortisol, free fatty acids and lactate in the plasma of subjects (1), but during the application of bupivacaine is observed increase in norepinephrine and one case of fatal hypoglycemia in patients with diabetes mellitus on insulin therapy (1). The most dangerous side effects occur as an effect on the CNS, anxiety and convulsions, followed by respiratory depression, induced by the subclavious nerve or respiratory center. Adverse effects as a result of sympathetic blockade on the cardiovascular system are hypotension, bradycardia and cardiac arrest.

### 3.1. Subjects and survey sample

The study is by its type of retrospective-prospective nature, clinical, comparative, longitudinal and observational. Complete research is completely spent at the Clinic for Anesthesiology and reanimation of Clinical Center of Sarajevo University (CCUS). The study included a total of 100 patients from the Clinic of Urology, Clinical Center of Sarajevo who underwent surgery by technique of transvesical prostatectomy (BPH) in which the indicators were set: a) repeated urinary retention; b) calculus and diverticulosis of the urinary bladder; c) urinary infection, d) repeated massive hamaturia, e) the distal obstruction that can lead to uremia.

According to the criteria defined the subjects were divided into two test groups: a) Group I (n=50)–patients underwent surgery under general anesthesia; b) Group II (n=50)–patients underwent surgery in local-regional anesthesia.

#### 3.2. Research methods

The study used two types of anesthesia: general and local-regional anesthesia. All patients included in the study (N = 100) received orally (PO) Midazolam, basal sedation in a dose of 7.5 mg, 60 minutes prior to surgery. During anesthesia are used the standard monitoring of patients included: following electrocardiogram (ECG) changes, heart rate, blood pressure, oxygen saturation (SaO₂), followed by pulse oximetry and expiratory concentrations of carbon dioxide (CO₂).

In the course of this research have been applied the standard methods of general and loco-regional anesthesia, which are routinely used in surgery of the prostate. Taking blood samples in order to determine the test levels of hormones relevant for this research was done by the standard procedure in the Central CCUS biochemical laboratory. Since the method for determining the levels of hormones are used by radio-type analysis of RIA and IRMA, based on the reaction immunochromal binding antigen-antibody complexes (1). These radioimmunoanalyze was used to determine the concentrations of six hormones: ACTH, prolactin, TSH, T3, T4, and cortisol. Sampling for the survey was carried out as follows:

The first blood sample was taken...
at screening purposes just before the introduction of general anesthesia or loco regional anesthesia. The second sample was taken during surgery during enucleation of prostate gland tissue. A third blood sample was taken 24 hours after surgery.

3.3. Administration of either type of anesthesia administered according to standard protocols

All patients included in the study were divided into two groups (I and II) depending on the application of different types of anesthesia according to the following protocols: Balanced general anesthesia was applied to a group of 50 patients (Group I) according to the following protocol: Before the introduction of general anesthesia was administered to respondents DHBP in doses of from 0.02 to 0.07 mg/kg of body weight (BW), and fentanyl 3μg/kg BW intravenously (IV) with oxygenation with 100% O₂. For an introduction to the state of anesthesia we used propofol (Diprivan®) at doses of 1.5 mg/kg BW, a relaxant for endotracheal intubation atracurium besilate (Tracrium®) in doses from 0.3 to 0.6 mg/kg BW in order to achieve complete neuromuscular block. According to the clinical picture, the depth of anesthesia, pain and sensitivity by achieved neuromuscular relaxation prescribed by the additional extra dose pharmaco the usual schemes.

After endotracheal intubation, general anesthesia was maintained with a mixture of gases (oxygen and nitrogen oxide in a ratio of 2:4), with the addition of volatile anesthetics and has been used sevoflurane (Sevoran®) with an average value of X = 69.95 (SD ± 5.5). According to the type of anesthesia, and the inclusion criteria, an equal number of respondents (N=50) was selected by two types of anesthesia—general and loco-regional. In 10% of patients the haemogram was corrected during the surgery, without differences in hormone values. Table 5 presents the mean values of hormones in relation to the type of anesthesia.

### Table 5. Mean values of hormones in relation to the type of anesthesia

<table>
<thead>
<tr>
<th>Hormone</th>
<th>General anesthesia</th>
<th>Loco-regional anesthesia</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACTH</td>
<td>Before surgery</td>
<td>207.32</td>
</tr>
<tr>
<td></td>
<td>During surgery</td>
<td>1560.38</td>
</tr>
<tr>
<td></td>
<td>After surgery</td>
<td>303.84</td>
</tr>
<tr>
<td>Prolactin</td>
<td>Before surgery</td>
<td>207.32</td>
</tr>
<tr>
<td></td>
<td>During surgery</td>
<td>1560.38</td>
</tr>
<tr>
<td></td>
<td>After surgery</td>
<td>303.84</td>
</tr>
<tr>
<td>TSH</td>
<td>Before surgery</td>
<td>1.54</td>
</tr>
<tr>
<td></td>
<td>During surgery</td>
<td>2.55</td>
</tr>
<tr>
<td></td>
<td>After surgery</td>
<td>1.10</td>
</tr>
<tr>
<td>T3</td>
<td>Before surgery</td>
<td>1.74</td>
</tr>
<tr>
<td></td>
<td>During surgery</td>
<td>1.55</td>
</tr>
<tr>
<td></td>
<td>After surgery</td>
<td>1.21</td>
</tr>
<tr>
<td>T4</td>
<td>Before surgery</td>
<td>117.70</td>
</tr>
<tr>
<td></td>
<td>During surgery</td>
<td>117.68</td>
</tr>
<tr>
<td></td>
<td>After surgery</td>
<td>117.08</td>
</tr>
<tr>
<td>Cortisol</td>
<td>Before surgery</td>
<td>404.88</td>
</tr>
<tr>
<td></td>
<td>During surgery</td>
<td>447.82</td>
</tr>
<tr>
<td></td>
<td>After surgery</td>
<td>504.62</td>
</tr>
<tr>
<td>FT3</td>
<td>Before surgery</td>
<td>4.66</td>
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<tr>
<td></td>
<td>During surgery</td>
<td>4.39</td>
</tr>
<tr>
<td></td>
<td>After surgery</td>
<td>3.55</td>
</tr>
<tr>
<td>FT4</td>
<td>Before surgery</td>
<td>17.53</td>
</tr>
<tr>
<td></td>
<td>During surgery</td>
<td>18.26</td>
</tr>
<tr>
<td></td>
<td>After surgery</td>
<td>19.53</td>
</tr>
</tbody>
</table>
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in applied anesthetic technique N=10.

According to the concomitants di-
gnoses observed in the distribution 
was a large number of different 
diseases, so it is aligned to several major 
groups, namely: a) cardiovascular dis-
ases—44.0%; b) diseases of the respira-
tory system—9%, d) and DM with arterial 
hypertension—8%; f) other diseases—14%.

Table shows the number of respond-
ents, the minimum and maximum 
values of ACTH, the mean and stan-
dard error and standard deviation 
of the two types of anesthesia. The larg-
est increase in ACTH values are re-
corded during surgery in both types 
of applied techniques of anesthesia, 
with a slightly higher maximum values 
achieved when using the technique of 
local-regional anesthesia, but the mean 
values, however maintained within the 
reffer ranges for both types of anes-
thesia. Table 1 shows the mean values 
of hormones measured preoperatively, 
intraperatively and postoperatively 
with general anesthesia and local-re-
gional one. As showed in Table 2 Bi-
ary logistic regression results indicate 
the significance of following changes 
in hormones values in relation to dif-
erent types of anesthesia received: a) 
Prolactin intraoperatively—General an-
esthesia; b) TSH intraoperatively—Gen-
eral anesthesia; c) T4 intraoperatively 
– Loco-regional anesthesia; d) Corti-
sol ↑ postoperatively–Loco-regional anesthesia.

5. DISCUSSION

Anesthesiology is the branch of clin-
ic medicine that studies and investi-
gates the processes that cause insensi-
tivity (1, 11, 12, 13, 14, 15). In case of 
general anesthesia have state of com-
plete insensitivity to external stimuli, 
which is caused by reversible depres-
sion of nerve cells. The term includes 
loss of consciousness, all the painful 
stimuli, fire defensive reflexes, and of-
ten the relaxation of skeletal muscles (6, 
7, 8, 9, 10). Listed effects may be caused 
by single anesthetic, but is most often 
caused multiple agents: anesthetic, an-
atalgesic, relaxant and inhalation anes-
ethetics, when we speak of a balanced an-
esthesia. Under the concept of regional 
anesthesia mean giving anesthetic epi-
dural, subdural, and perform block an-
esthesia. The patient is conscious, with 
preserved reflexes, breathing spontane-
ously. Giving an anesthetic, a part of 
the body below the injection site becomes 
insensitive to external stimuli (1, 10, 13).

Increased levels of ACTH intraop-
erative in both anesthesia techniques 
applied, with a slightly larger increase 
in the value of the respondents with 
technique of general anesthesia(1, 14, 
15). The values of ACTH after 24 hours 
showed a return to preoperative values 
in case of both techniques of anesthesia.

Increased levels of PRL intraoperative 
in both anesthesia techniques applied, 
with larger peak values registered in pa-
tients under technique of general anes-
thesia (3554μIU/L) (1). High levels of PRL 
amerained and postoperatively after 
24 hours with both techniques ap-
plied anesthesia. Increased intraopera-
tive levels of TSH in both anesthetic 
techniques, with higher maximum val-
ues in patients with technique of gen-
eral anesthesia (7.20 mU/L). The values 
of TSH postoperatively after 24 hours 
showed a return to baseline in case of 
both applied technique of anesthesia.

Low intraoperative values of T3 in 
both anesthetic techniques. Lower val-
ues of T3 are still continuing after 24 
hours postoperatively in both applied 
techniques of anesthesia. The values of 
T4 hormone in subjects under gen-
eral anesthesia did not show major de-
viations intraoperatively or postoper-
atively. Low intraoperative values of 
T4 in patients with regional anesthesia 
with a gradual increase in the value 
postoperatively. After 24 hours the reg-
istered value of T4 does not reach the 
preoperative values. Increased levels 
of cortisol both intraoperatively and 
24 hours postoperatively for both an-
esthetic techniques.

Hormonal response in relation to 
regional anesthesia General anesthesia 
may limit the perception of stimuli from 
injury, but does not eliminate the full 
response to noxious stimuli, even with 
deep anesthesia. All intravenous agents 
and volatile anesthetics in normal doses 
have little effect on the endocrine and 
physiological functions. Neural block-
ade induced by regional anesthesia or 
local anesthetics have a direct impact 
on endocrine and metabolic response. 
The basic mechanism of neural block-
ade of stress response to surgical inter-
vention is completely preventing pain 
signals from the operating field reach 
the CNS. Inhibitory effects of neural 
blockade on endocrine and metabolic 
response during surgical procedures 
also apply to the afferent and efferent 
pathways (1, 10, 15, 16, 17).

Regional anesthesia causes com-
plete sensory block, which prevents 
the poor stimulus in the area of the surgi-

### Table 2. The variables in the regression analysis. A variables in step 1: ACTH\_2, ACTH\_3, Prolactin\_2, Prolactin\_3, TSH\_2, TSH\_3, T3\_2, T3\_3, T4\_2, T4\_3, Cortisol\_2, Cortisol\_3.

<table>
<thead>
<tr>
<th>Step 1(a)</th>
<th>B</th>
<th>S.E.</th>
<th>Wald</th>
<th>df</th>
<th>Sig.</th>
<th>Exp(B)</th>
<th>95.0% confidence interval</th>
<th>EXP(B)</th>
<th>Lower bound</th>
<th>Upper bound</th>
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<td>-0.01</td>
<td>0.04</td>
<td>0.23</td>
<td>1</td>
<td>0.879</td>
<td>0.999</td>
<td>0.991</td>
<td>1.008</td>
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<tr>
<td>ACTH_3</td>
<td>-0.04</td>
<td>0.034</td>
<td>2.007</td>
<td>1</td>
<td>0.157</td>
<td>0.953</td>
<td>0.891</td>
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<td>0.001</td>
<td>11.154</td>
<td>1</td>
<td>0.001</td>
<td>0.998</td>
<td>0.997</td>
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<tr>
<td>Prolactin_3</td>
<td>-0.001</td>
<td>0.002</td>
<td>0.002</td>
<td>2</td>
<td>0.002</td>
<td>0.999</td>
<td>0.995</td>
<td>1.002</td>
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<tr>
<td>TSH_2</td>
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<td>TSH_3</td>
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<tr>
<td>T3_2</td>
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<td>3.448</td>
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<td>-1.957</td>
<td>1.088</td>
<td>3.233</td>
<td>1</td>
<td>0.072</td>
<td>0.141</td>
<td>0.017</td>
<td>1.193</td>
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<tr>
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<td>-0.003</td>
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<td>0.002</td>
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<td>0.998</td>
<td>0.998</td>
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<td>2</td>
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<tr>
<td>Cortisol_2</td>
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<td>0.009</td>
<td>0.002</td>
<td>2</td>
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<td>0.998</td>
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<td>0.998</td>
<td>0.998</td>
<td>1.006</td>
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<tr>
<td>Constant</td>
<td>5.086</td>
<td>2.283</td>
<td>4.964</td>
<td>1</td>
<td>0.026</td>
<td>161.807</td>
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</table>

Table 2: The variables in the regression analysis. A variables in step 1: ACTH\_2, ACTH\_3, Prolactin\_2, Prolactin\_3, TSH\_2, TSH\_3, T3\_2, T3\_3, T4\_2, T4\_3, Cortisol\_2, Cortisol\_3.
cal field. This is not the case with general anesthesia, which generally does not prevent surgical stimuli or CNS reactions and stress responses, and Sometimes the creation of abnormal reflexes (12).

Extensive epidural local anesthetic will prevent endocrine and metabolic responses of surgery pelvis and lower abdomen. Epidural blockade of T4 and T5 dermatome was achieved before surgery prevented the increased value of cortisol and glucose response to hypotension, but hypotension may abate for sympathetic block by correction. Litotomy position may compensate for discomfort caused by bladder distension. Up to T10 is requested in order to avoid spinal analgesia. Block of T4 and T5 dermatome was achieved before surgery prevented the increased value of cortisol and glucose response to hypotension, but hypotension may abate for sympathetic block by correction.

Regional anesthetic techniques reduce the incidence of thromboembolic complications in surgery of pelvis and lower extremities. Regional anesthesia is effective in reducing some cardiovascular responses to surgery are usually the result of sympathetic activation. The same author says in conclusion that regional anesthesia is local anesthetic inhibits the stress response to surgery and may also have an impact on the postoperative result of its beneficial effects on some organic functions (13).

Spinal anesthesia offers several advantages over general anesthesia. It is especially useful in patients with significant respiratory disease. Provides a good postoperative analgesia and may reduce the stress response to surgery. Spinal level is limited with the level of T1. Spinal anesthesia has traditionally been avoided in patients with ischemic heart disease, however, the incidence of myocardial ischemia is the same with a spinal as with general anesthesia. Block up to T10 is requested in order to avoid discomfort caused by bladder distension. Litotomy position may compensate for sympathetic block by correcting venous return, but hypotension may occur when the foot landed on the end of surgery (1).

Neural blockade reduces the percentage of deep vein thrombosis by 44%, pulmonary embolism by 50%, pneumonia by 39%, respiratory depression by 59%. It also reduces the possibility of myocardial infarction and renal failure (study included 9559 patients) (1). Patients with epidural anesthesia had less postoperative pain (compared to those under general anesthesia and technique of combined epidural and general anesthesia) (1). The success of intraoperative adverse blockades of afferent signals to the CNS is important in reducing postoperative pain (15). There are several advantages of regional anesthesia. One of them is better pulmonary function and its recovery after regional anesthesia than after general anesthesia. During regional anesthesia, there is a reduction in preload and after load, which sometimes require treatment. Improvement of coronary circulation and reduction of infarct zone may be explained by reduced myocardial oxygen requirements, before special effects of regional anesthesia. Most controversy is related to stress reduction with regional anesthesia compared to general anesthesia. The problem is that we really do not know whether the decline in the overall stress response necessarily beneficial. Some studies suggest that stress response is required for survival of stress (17, 18, 19, 20, 21) says that the assumption that regional anesthesia reduces morbidity and mortality remains unproven. Epidural analgesia provides excellent analgesia (pain relief), which is in itself enough to justify its use.

In the literature there are many controversial reports on the benefits of regional anesthesia and analgesia, and its impact on the outcome of treatment (17, 18, 19). There are three main methods for the modification of the endocrine and metabolic responses. First, the application of neural blockade, epidural or spinal analgesia, to prevent the transmission of impulses from the site of trauma. Second, intravenous administration of high doses of potent opiate analgesics to block the hypothalamic-pituitary function. Third, the hormonal status of the patient can be changed, or the use of agents that inhibit the secretion or action katabolic hormones, or infusion of anabolic hormones, such as the insulin (14).

6. CONCLUSION

Most striking results of this study were obtained by using sophisticated statistical methods of binary logistic regression analysis: A significant increase in prolactin intraoperatively, for respondents under general anesthesia. A significant increase in TSH values intraoperatively for respondents under general anesthesia. A significant drop in T4 intraoperatively in patients with regional anesthetic technique. A significant increase in cortisol values 24 hours postoperatively in patients with regional anesthetic technique.