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RHINOLOGY

Patient specific or routine preoperative workup in septoplasty: which one is cost-effective?

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Abstract This study aimed at determining the limits of preoperative investigation and calculate estimated cost analysis in septoplasty with and without turbinate surgery. A retrospective chart review. The study was conducted at secondary referral center. A retrospective chart review of patients who have undergone septoplasty over a 1-year period was performed. The need for routine (battery testing) versus patient specific preoperative workup of 380 septoplasty patients was evaluated. Mean age of the patients was 31.5 ± 4.6. The patients were classified into three groups according to preoperative routine laboratory testing results: (1) normal group (2) abnormal group and (3) abnormal out of action limit group. Medical records were revaluated by an anesthesiologist and ear nose throat doctor according to preoperative American Society of Anesthesiologists guidelines to calculate estimated possible costs in case of patient specific preoperative workup. Three hundred seventy-seven patients were within ASA 1 group and three patients were within ASA 2. According to preoperative battery testing results, 5.8 % of the patients ($n = 22$) were in group 1, 93.4 % ($n = 355$) were in group 2, 0.8 % ($n = 3$) were in group 3. Surgery was postponed due to concomitant pathologies for about 44 days (10–180 days) in four patients (1.1 %). Preoperative routine laboratory testing costs were calculated as \$41.08 ± 6.69 (40.25–128.78) per patient. When medical records were reevaluated retrospectively, estimated cost per patient would be \$8.91 ± 10.40 (7.18–79.91) if patient specific preoperative workup were done. Individual preoperative testing would save \$12,226.78 annually and total cost would decrease from \$15,612.41 to \$3,385.62. ($p = 0.001$). Patient-specific preoperative workup is more cost effective than routine battery testing in septoplasty with and without turbinate surgery.

Keywords Septoplasty · Cost analysis · Patient specific preoperative workup · Routine preoperative workup

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Introduction

Septoplasty with or without turbinate reduction/outfracture is the most performed surgery both in private and public practices. Preoperative evaluation is important for the safety of this surgery as well. American Society of Anesthesiologists (ASA) Task Force on Pre-anesthesia Evaluation (2002) defined preoperative evaluation into two groups: Routine (battery) and individual assessment [1]. Routine testing includes hemogram, blood chemistry, bleeding tests (PT, aPTT, INR), ECG and chest X-ray for

general anesthesia. Routine testing may cause waste of money and increase cost of the surgery essentially. Patient specific preoperative evaluation according to surgical procedures was modified by Turkish Society of Anesthesiology and Reanimation (TSAR) in 2010 [2]. These guidelines were used in this particular study.

In this article, the need for patient specific versus routine preoperative workup for septoplasty patients was evaluated retrospectively over a year period and estimated cost analysis was calculated using guidelines.

Materials and methods

Medical records of 380 patients who underwent septal surgery with or without turbinate reduction were investigated retrospectively over a year period at a secondary referral hospital by one anesthesiologist (HD) and two ENT specialists (HY, SD). Patient's age ranged between 12 and 60, mean 31.5 ± 4.6. We recorded medical history, physical examination, number, specification and findings of all preoperative testing. Routine (battery) testing includes complete blood count, biochemical parameters (glucose, urea, creatine, alanine transaminase, aspartate transaminase, bilirubine, sodium, potassium, and chlorine), coagulation tests (prothrombin time, active prothrombin time, international normalized ratio), hepatitis markers, chest X-ray, electrocardiography. The patients were classified into three groups according to preoperative routine blood laboratory testing results: (1) normal group, (2) abnormal group and (3) abnormal out of action limit group. Abnormal group means that the results are not within normal limits, mostly minimally higher than upper cut-off point and could be ignored according to history and physical examination. Abnormal out of action group was determined to the surpassing the threshold of abnormality results which effects delaying of elective surgery and anesthetic managements [3]. Total costs of preoperative evaluation including laboratory tests, consultation fees and additional tests (except surgery's price) were calculated and recorded for each patient by the Director of Clinical Laboratories. The costs of all testing and surgery are standardized across all state hospitals in our country. After the calculation of estimated costs based on chart review, all records were reevaluated by the authors (anesthesiologist and ENT surgeon) and minimum required tests for safe surgery were determined according to the criteria in practice advisory pre-anesthesia evaluation [1] reported in 2002 and Turkish Society of Anesthesiology and Reanimation (TSAR) preoperative guidelines [2] (Table 1). This second evaluation was actually based on patient-specific workup other than routine battery testing. Finally, the estimated cost of patient-specific workup was calculated and the costs of routine testing and possible estimation of patient-specific testing were compared.

Ethic committee approval was obtained.

Results

The chart review of 380 patients who underwent septoplasty and/or turbinate reduction was performed. 377 patients were ASA 1 and three patients were ASA 2. Mean age was 31.5 ± 4.6 (12–60). 12 patients (3.2 %) had concomitant disease (bronchiolitis, major depression, hepatitis, hypothyroidism, epilepsy, hypertension, previous myocard infarction, and diabetes mellitus). Seven patients were consulted to the related departments and operation of four patients (1.1 %) were delayed in accordance with consultations for a duration of 44.2 ± 37.6 day (10–180). Surprisingly, hepatitis patient was unaware of his disease preoperatively and diagnosis was done by routine laboratory hepatitis markers, ultimately his operation was delayed for 6 months according to gastroenterology consultation.

According to preoperative routine blood battery testing from the chart review, 5.8 % of patients ($n = 22$) were within normal group, 93.4 % ($n = 355$) were within abnormal group and 0.8 % ($n = 3$) were within abnormal out of action limit group and further testing and investigation were ordered for this group. Distribution of groups and abnormalities are shown in Table 2. Additional tests were applied to 1.3 % of patients ($n = 5$) (Table 3).

Although routine preoperative coagulation tests were ordered for these 380 patients, only 15 patients showed coagulation abnormalities which did not cause any postoperative bleeding. Coagulation tests of all patients who had epistaxis complication were in normal laboratory findings group. Moreover abnormal out of action group patients had hepatitis B antigen positivity, hyperglycemia and thyroid function tests abnormalities.

While total costs of routine preoperative evaluation including laboratory tests, consultation fees and additional tests except surgery were $41.08 ± 6.69 (40.25–128.78) per patient, cost of patient-specific preoperative workup based on guidelines was calculated as $8.91 ± 10.40 (7.58–79.91). Patient-specific preoperative workup would save $12,226.78 annually and preoperative investigating cost would decrease from $15,612.41 to $3,385.62, which was statistically significant ($p = 0.001$) (Fig. 1).

Comparison of cost analysis was done with paired sample T test and comparison of multiple parameters analysis was done with Pearson Ki square test. $p < 0.05$ was considered as statistically significant.

Table 1 Surgery's grade classification and preoperative test ordering guidelines for ASA 1 patients

Age	<16	16–40	40–61	61≤
Grade 1: Minor surgical operations which don't effects vital organs and the time of surgery is <30 min (abscess drainage, lipoma excision, breast biopsy, miringotomy etc)	None	None	Hgb-HCT ECG NaK, Cl Blood glucose	CBC ECG, Na, K, Cl Blood glucose BUN Creatinine
Grade 2: Surgeries which have minor effect on vital organs and last 30 min–1 h (inguinal hernia operation, tonsillectomy, arthroscopy, cystoscopy etc)	Hgb HCT	CBC	CBC ECG	CBC ECG Na, K, Cl Blood glucose BUN Creatinine
Grade 3: Surgeries which have risk for blood transfusion, last for 1–4 h and have moderate effect on vital organs (gastric resection, abdominal hysterectomy, middle ear surgery, etc)	CBC	CBC Na, K, Cl Blood glucose	CBC ECG Na, K, Cl Blood glucose BUN Creatinine	CBC Chest X-ray ECG Na, K, Cl Blood glucose BUN Creatinine
Grade 4: Surgeries which have risk for major bleeding, lasts for long time, have major effect on vital organs (radical prostatectomy, total hip replacement, radical neck dissection, vertebral surgery, etc)	CBC Na, K, Cl BUN Creatinine	TKS Na, K, Cl Blood glucose BUN Creatinine PT-PTT	CBC ECG Na, K, Cl Blood glucose BUN Creatinine PT-PTT	CBC Chest X-ray ECG Na, K, Cl Blood glucose BUN Creatinine PT-PTT

Permission to use table was obtained from TSAR

Discussion

Healthcare expenses are persistently on the rise and therefore it is necessary to develop strategies for cost reduction with maximum surgical safe. This study addressed the cost effectiveness of patient-specific preoperative workup or routine preoperative testing in patients underwent nasal septal surgery.

Table 2 Distribution of preoperative laboratory findings

	n	%
Normal laboratory findings	22	5.8
Biochemical abnormalities	19	5.0
Hemogram abnormalities	67	17.6
Biochemical + hemogram abnormalities	254	66.8
Biochemical + hemogram + coagulation abnormalities	14	3.7
Biochemical + coagulation abnormalities	1	0.3
Abnormalities out of action limits, ELISA, biochemical (*n*:2)	3	0.8
Preoperative laboratory tests		
Normal	22	5.8
Abnormal	355	93.4
Abnormal out of action limits	3	0.8

Septoplasty with and without turbinate surgery is one of the most common procedure in otolaryngology practice. At our secondary referral center, the most common otolaryngologic procedure was septal surgery, so septoplasty was preferred as a model for reducing costs. Further studies including other common otolaryngologic procedures may be conducted at centers where these procedures are commonly performed.

Preoperative workup costs for septoplasty have not been studied previously. Preoperative assessment enables predicting the possible complications of surgical procedure, reduces the morbidity, helps selecting the type of anesthesia, increases the quality and decreases the cost of perioperative care. Preoperative investigation includes patient's history, clinical examinations and laboratory investigations such as blood testing, electrocardiogram and

Table 3 Multiple parameter analysis for preoperative laboratory tests

	Preoperative laboratory findings			*p*
	Normal ($n = 22$) *n* (%)	Abnormal ($n = 355$) *n* (%)	Abnormal out of action limits ($n = 3$) *n* (%)	
Age				
0–15	0 (0)	1 (0.3)	0 (0)	0.939
16–40	21 (95.5)	347 (97.7)	3 (100)	
41–65	1 (4.5)	7 (2.0)	0 (0)	
Additional tests	0 (0)	2 (0.6)	3 (100)	0.001*
Concomitant disease	0 (0)	9 (2.5)	3 (100)	0.001*
Operation delay	0 (0)	1 (0.3)	3 (100)	0.001*
Complication	0 (0)	4 (1.1)	0 (0)	0.867

Pearson chi square test

* $p < 0.01$

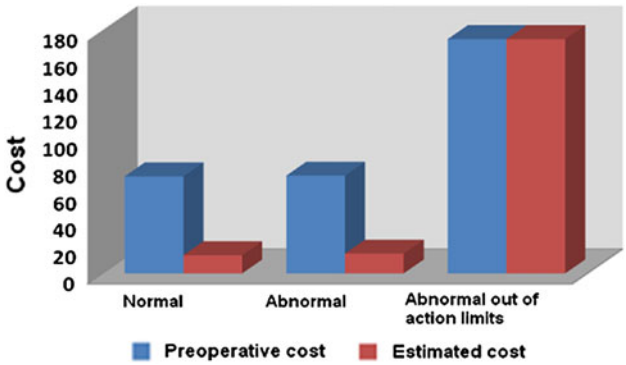

Fig. 1 Comparison of preoperative and estimated cost analysis for preoperative laboratory test groups

radiological assessment. Various methods of approach were defined to find optimal evaluating process. In 1940s preoperative assessment was done by clinical examination and history only and selective laboratory tests were used when necessary [4]. Biochemical auto-analyzers had been discovered and multiple parameters in blood samples could be processed quickly with a low cost with industrial advances [5]. There are several potential explanations for choosing routine battery testing; ingrained habits, medico-legal worries, concern about delay of surgery, 'the other doctor requires these test' opinion, lack of awareness of evidence and guidelines [6, 7]. However, various studies showed that in asymptomatic patients with normal clinical history and physical examination, frequency of abnormal laboratory test results were very low and 60–75 % of patients would not have required any test [3, 8, 9]. Kaplan et al. reviewed elective surgical patients with battery preoperative testing and found out only 22 % tests abnormalities. In this particular study, only 0.8 % of the asymptomatic patients had considerable abnormal preoperative findings needed further investigation. The ratio may be lower than the other studies due to the specific patient group containing only septoplasty with and without turbinate surgery. The authors recommend patient-specific preoperative workup rather than routine battery testing.

In US, 18 billion dollars is being paid for preoperative testing annually [10, 11] and at least 10 billion of them could be saved by the assessment of individual testing [12]. In this study the annual cost of septoplasty was $15,612.41 with battery testing. However the cost could be decreased to $3,385.62 when assessed with patient-specific testing. This means that $12,226.79 could be saved annually for these 380 patients. $12,000 saving may be seen as a negligible amount. Because this study was conducted in a single institution and all these figures should be thought within the context of state hospitals' rates. In other words, these results can not be generalized to all types of hospital. Same operation costs $7,000 per patient at private hospitals in the context of patient-specific workup. Moreover reimbursement systems differ in all over the world. Tests have different costs in different healthcare systems. So, the amount of cost saving may also differ in all over the world. Costs caused by these unnecessary testing (battery testing) might be even higher due to unnecessary postponement of surgery or unnecessary further investigation although only two patient was postponed due to abnormal laboratory result (HbsAg positivity, hyperglycemia) in our study. Ultimately, all these results may be important for policy makers in health care systems. The policy makers may also insist on standardization of patient-specific preoperative workup according to guidelines to increase healthcare quality and at the same time to decrease unnecessary costs.

Conclusion

Our results demonstrate that patient-specific preoperative workup is more cost effective than routine battery testing in septoplasty with and without turbinate surgery. To decrease the expenditure and to do safe surgery patient specific preoperative workup should be ordered according to guidelines.

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