

ANALYSIS OF BLOOD LOSS AFTER VENTRAL AND POSTERIOR CORRECTIVE SPINAL FUSION IN PATIENT WITH IDIOPATHIC SCOLIOSIS

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It was prospective analysis of 36 patients with idiopathic scoliosis in order to compare the intraoperative and early postoperative blood loss after ventral and posterior corrective spinal fusion. All patients were divided into two groups: group 1 - 18 patients (14 females and 4 males) with a mean age of $17,2 \pm 3,4$ years treated with ventral corrective spinal fusion and group 2 - 18 patients (17 females and 1 male) with a mean age of $15,9 \pm 3,4$ years with posterior corrective spinal fusion. Mean values and standard deviation of the time of surgery, intraoperative blood loss, transfusion volume, hemoglobin, blood volume loss and drainage loss and number of fused spinal levels were evaluated. The results were compared using the Mann-Whitney test ($p \leq 0,05$). It was found that group 1 had a lower intraoperative blood loss, the average volume of blood transfusion and blood loss drain in the early postoperative period compared with group 2. It was concluded that ventral corrective spinal fusion is associated with less intraoperative and early postoperative blood loss which is probably due to the less traumatic access and length of the spine instrumentation.

KEY WORDS: Idiopathic scoliosis, ventral corrective spinal fusion, posterior corrective spinal fusion, blood loss

АНАЛІЗ КРОВОВТРАТИ ПІСЛЯ ВЕНТРАЛЬНОГО ТА ЗАДНЬОГО КОРИГУВАЛЬНОГО СПОНДИЛОДЕЗУ У ХВОРИХ НА ІДІОПАТИЧНИЙ СКОЛІОЗ

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Проведено проспективний аналіз 36 хворих ідіопатичним сколіозом з метою порівняння інтраопераційної і ранньої післяопераційної крововтрати після вентрального і заднього коригуючого спондилодеза. Всі пацієнти були розділені на дві групи: група 1 - 18 осіб (14 жіночої і 4 чоловічої статі) з середнім віком $17,2 \pm 3,4$ років, яким було проведено вентральний коригувальний спондилодез і група 2 - 18 осіб (17 жіночої та 1 чоловічої статі) з середнім віком $15,9 \pm 3,4$ років, яким виконаний задній коригувальний спондилодез. Визначали середні показники та стандартне відхилення тривалості хірургічного втручання, інтраопераційної крововтрати, об'єму гемотрансфузії, рівню гемоглобіну, об'єм втрати дренажної крові та кількості фіксованих імплантатом рівнів. Отримані результати порівнювали за допомогою критерію Манна-Уїтні ($p \leq 0,05$). Було встановлено, що в групі 1 відзначалися менші інтраопераційна крововтрата, середній обсяг гемотрансфузії і втрати дренажної крові в ранньому післяопераційному періоді в порівнянні з групою 2. Таким чином, проведення вентрального коригувального спондилодеза супроводжується меншою інтра- і ранню післяопераційною крововтратою, що, імовірно, пов'язано із меншою травматичністю доступу і більшою протяжністю інструментації хребта.

КЛЮЧОВІ СЛОВА: ідіопатичний сколіоз, вентральний спондилодез, задній спондилодез, крововтрата

АНАЛИЗ КРОВОПОТЕРИ ПОСЛЕ ВЕНТРАЛЬНОГО И ЗАДНЕГО КОРРИГИРУЮЩЕГО СПОНДИЛОДЕЗА У БОЛЬНЫХ ИДИОПАТИЧЕСКИМ СКОЛИОЗОМ

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Проведен проспективний аналіз 36 больних ідіопатическим сколіозом с целью сравнения интраоперационной и ранней послеоперационной кровопотери после вентрального и заднего

корректирующего спондилодеза. Все пациенты были разделены на две группы: группа 1 – 18 человек (14 женского и 4 мужского пола) со средним возрастом $17,2 \pm 3,4$ лет, которым был проведен вентральный корректирующий спондилодез и группа 2 – 18 человек (17 пациентов женского и 1 мужского пола) со средним возрастом $15,9 \pm 3,4$ лет, которым выполнен задний корректирующий спондилодез. Определяли средние показатели и стандартное отклонение длительности хирургического вмешательства, интраоперационной кровопотери, объема гемотрансфузии, уровня гемоглобина, объема потери дренажной крови и количества фиксированных имплантатов уровней. Полученные результаты сравнивали с помощью критерия Манна-Уитни ($p \leq 0,05$). Было установлено, что в группе 1 отмечались меньшие интраоперационная кровопотеря, средний объем гемотрансфузии и потери дренажной крови в раннем послеоперационном периоде по сравнению с группой 2. Таким образом, проведение вентрального корректирующего спондилодеза сопровождается меньшей интра- и ранней послеоперационной кровопотерей, что, вероятно, связано с меньшей травматичностью доступа и протяженностью инструментации позвоночника.

КЛЮЧЕВЫЕ СЛОВА: идиопатический сколиоз, вентральный спондилодез, задний спондилодез, кровопотеря

INTRODUCTION

Surgery on the spine which aims spinal deformity correction involves significant blood loss. Development of new methods of prevention and the use of current generation hemostatic agents allow reducing intraoperative blood loss, but is not possible to prevent blood transfusion completely [1]. Blood transfusion increases the risk of postoperative complications such as transmission of infectious diseases, the post hemotransfusion reactions development, immune system dysfunction and acute lung injury [2].

Risk factors for significant intraoperative blood loss are concomitant blood disorders, cardiovascular and respiratory system comorbidities, the degree of deformity, prolonged surgery, traumatic surgical approach, and greater number of the instrumented vertebrae [3].

In terms of risk factors prevention that are directly related to the surgery, the use of ventral corrective spinal fusion theoretically reduces intraoperative blood loss in the virtue of less fixation length, lesser degree of muscle injury during surgical approach in comparison to posterior corrective spinal fusion. There is lack of research [4, 5] in the contemporary scientific literature, which compare the degree of blood loss after ventral corrective fusion (VCF) versus posterior corrective fusion (PCF) in patients with idiopathic scoliosis that makes this research relevant.

OBJECTIVE

Purpose of the study is to conduct comparative analysis of intraoperative and early postoperative blood loss in patients with

idiopathic scoliosis after ventral and posterior corrective spinal fusion.

MATERIALS AND METHODS

The study has been performed at SE «Sytenko Institute of Spine and Joint Pathology, AMSU» within the research work «To define criteria for selecting the method of instrumental ventral spinal fusion for scoliosis correction» (№ state registration 0111U010382). Study design - prospective, comparative.

To perform the study, 36 patients operated for idiopathic scoliosis in pediatric orthopedics departments of Sytenko Institute and National specialized children hospital Okhmatdyt were selected. The inclusion criteria in the study were: the presence of thoracic or thoracolumbar idiopathic scoliosis (Lenke 1A type and 5C), age over 12 years, patients who underwent VCF and PCF. Exclusion criteria were: blood disorders, congenital and acquired chronic diseases of the cardiovascular system, respiratory insufficiency grade 3 (vital capacity less than 65 % of predicted). Depending on the type of surgery, patients were divided into two groups (18 patients each). The first group included 14 female patients and 4 male in the mean age of $17,2 \pm 3,4$ years. In the second group there were 17 females and 1 male. The mean age of this group was $15,9 \pm 3,4$ years. Index Cobb angle of the main curve before the surgery was $49^\circ \pm 7,9^\circ$ in the first group and $53^\circ \pm 8,7^\circ$ - in the second, and after the surgery $18,9^\circ \pm 6,7^\circ$ and $11,5^\circ \pm 6,7^\circ$ respectively.

During the study, we analyzed the average duration of the surgery, intraoperative blood loss, transfusion volume, hemoglobin levels before, immediately after and 3 days post-

peratively. Also were determined the amount of drainage blood loss 3 days after the surgery and number of fused spinal levels. After VCS chest tube was placed for passive and active drainage of the pleural cavity, and after PCF - direct active wound drainage was used.

Indications for blood transfusion considered reducing hemoglobin less than 80 g / dL, hematocrit less than 25 %, and clinical signs of anemia (pale skin and mucous membranes, tachycardia, systolic murmur, etc.). As hemostatics all patients received tranexamic acid intravenously at a dose of 10 mg/kg at the beginning and 6 hours after surgery.

Mathematical testing of the obtained data was performed using Statistical Package IBM, parameters mean values and standard deviation (M ± sd) were calculated using the software. We used Mann-Whitney test (p ≤ 0,05) to compare average time of surgery, intraoperative blood loss volume and blood transfusion, hemoglobin levels and the volume of blood drainage output between the groups.

RESULTS AND DISCUSSION

The table presents the average values in both groups of patients.

In the first group of patients preoperative hemoglobin index was 130,7 ± 7,6 g / l on the average, immediately after surgery it decreased to 119,2 ± 19,8 g / l, and on the third postoperative day it was 105,5 ± 12,7 g / l. Mean blood loss in VCF patients during surgery was 514,3 ± 42,6 ml , and duration of surgery was 345,7 ± 39,1 min. on the average. The total volume drainage blood output for the first three postoperative days was 630 ± 275,3 ml on the average. Hemotransfusion performed in one patient from the VCF group. Therefore, the average volume of transfused blood was 18,9 ± 73,1 ml. The average length of fixation was 4.8 spinal segments.

In the second group of patients mean preoperative hemoglobin was 138,1 ± 8,1 g/l, immediately after PCF - 108,5 ± 19,1 g/l and 101,7 ± 13,3 g/l three days postoperatively. Surgery duration was 276,7 ± 30,1 min on the average, estimated blood loss was 710,5 ± 58,7. In this group mean drainage blood loss was 858,2 ± 312,7 ml in the early postoperative period. Transfusion avoided in 2 patients only, and its average volume for the 2nd group was 243,9 ± 129,3 ml. Mean instrumentation length was 9.4 vertebrae.

Table 1

Analyzed data of the patients from 1st and 2nd groups

Parameters	1 st group		2 nd group		P (Mann-Whitney test)
	M	sd	M	sd	
Hb preop, g/l	130,73	7,59	138,11	8,076	0,021
Hb postop, g/l	119,2	19,83	108,58	19,18	0,15
Hb 3 days postop, g/l	105,5	12,74	101,64	13,36	0,38
Duration , min.	345,66	39,1	276,66	30,09	0,245
Drainage output, ml	630	275,31	858,23	312,47	0,078
Hemotransfusion, ml	18,86	73,07	243,88	129,27	0,00007
Blood loss, ml	514,3	42,6	710,54	58,7	0,368

Comparing obtained data between groups showed that there were no statistically significant differences between mean hemoglobin values after surgery and on the third postoperative day. Intraoperative blood loss in PCF patients was higher by 26.6 %

compared to patients after VCF, at the same time ventral spinal fusion took 20 % more time than posterior. Drainage blood loss was lower by 26.5 %, and the hemotransfused blood volume was statistically significantly lower in the first group by 92.2 % (fig.1).

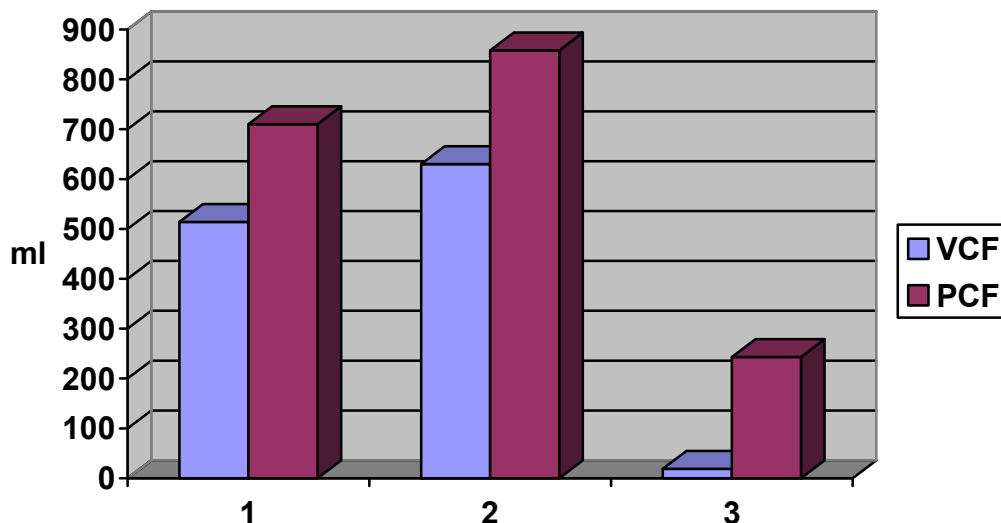


Fig. 1 Graphs of intraoperative blood loss (1), drainage blood loss (2), hemotransfusion volume (3) in VCF and PCF groups.

Significant blood loss during surgery is a serious complication that affects the quality of treatment of the spinal deformity. Modern blood salvage strategies involve measures that begins at the prehospital stage. All these measures are sufficiently effective and have certain advantages and disadvantages. Thus, the most effective is the maximum possible reduction of the surgical trauma [6].

We compared intra- and postoperative blood loss in patients with idiopathic scoliosis after short-segment VCF and selective PCF. We found that despite the greater duration of the ventral spinal fusion intraoperative blood loss was greater in patients after transpedicular fixation, due to the need of massive layer of back muscles dissection when performing posterior approach, and with the greater length of spinal fusion length. This fact can also be explained by higher volumes of drainage blood loss in the first three days after surgery in patients from the second group. Same hemoglobin values during the observation period indicate adequacy of blood salvage

measures in patients from both groups, during surgery as well as in the postoperative period.

CONCLUSIONS

1. Ventral corrective spinal fusion in comparison to posterior corrective spinal fusion allows reducing intraoperative and early postoperative blood loss in idiopathic scoliosis patients.

2. In our study, application of the ventral spinal fusion for the spinal deformity correction significantly reduced the volume of blood transfusion.

3. Main factors affecting the degree of blood loss during surgery and in the early postoperative period are the type of surgical approach, fixation length, and therefore the size of the bone wound.

PROSPECTS FOR FUTURE STUDIES

Future studies should be directed to the optimization of blood salvage procedures and application of pharmaceutical agents for reducing blood loss after posterior scoliosis surgery.

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