COMPARATIVE EVALUATION OF A CONTROLLED CLINICAL TEST OF APPARATUS INTRAOPERATIVE REINFUSION OF BLOOD COLLECTED FROM THE PLEURAL CAVITY UNDER SLOW AND FAST MODES

Chyngysheva Zh.A., Tilekov E.A., Turdusheva D.K., Turdiev U.M., Nazarbekov D.K., Kubanychbekova A.K.

I.K. Akhunbaev Kyrgyz state medical academy, Bishkek, Kyrgyz Republic

https://doi.org/10.35805/BSK2022I031

Chyngysheva Zh.A.
orcid.org/0000-0002-6099-8090

Tilekov E.A.
orcid.org/0000-0001-6764-6613

Turdusheva D.K.
orcid.org/0000-0002-2759-3366

Turdiev U.M.
orcid.org/0000-0003-3605-6914

Nazarbekov D.K.
orcid.org/0000-0001-9702-9229

Kubanychbekova A.K.
orcid.org/0000-0003-0322-423X

Corresponding author:
Chyngysheva Zh.A. *- Head of the Department of Anesthesiology and IC, DMSc, Associate Professor, I.K. Akhunbaev Kyrgyz State Medical Academy, Bishkek, Kyrgyz Republic*
E-mail: amanova-j@mail.ru

Conflict of interest
The authors declare that they have no conflicts of interest

Abstract

Objective. *An analysis of the study, in the mode of fast and slow blood exfusion, controlled clinical trials showed that the number of platelets was significantly reduced.*

Material and methods. We have conducted a series of researches in 44 patients with cavitary blood loss, which is 34.3% of the total number of the examined patients (n-128), for whom an IOBR apparatus technology was used. The studies were also conducted during the surgery in the first 2 hours.

Results. *Controlled clinical trials (CCT) have shown that blood exfusion after intraoperative blood reinfusion, the degree of destruction of erythrocytes and leukocytes with slow blood exfusion is 35%, and with fast - 48%. Osmotic resistance is reduced by 3 times. With rapid hardware exfusion, blood hemolysis is more than 28%, which should be taken into account when performing hardware intraoperative blood reinfusion. Controlled clinical trials have shown that the faster the machine exfusion is performed, the greater the decrease in protein and bilirubin content. In the blood collected in the mode of rapid apparatus exfusion, a higher concentration of K +, residual N and urea is noted. Controlled clinical trials have shown that platelet counts are significantly reduced, especially when using a rapid blood collection regimen. Against this background, the process of aggregation is reliably slowed down, and with a fast mode of blood collection - 2 times in comparison with the control. Plasma recalcification time is reliably reduced by 40% when using a high-speed blood collection mode in comparison with the control values, which is almost 3 times higher than when using slow blood aspiration.*

Conclusion. *The article provides an analysis of scientific research, CCT, experimental control, clinical control and practical work. The work is interdisciplinary in nature, written at the intersection of surgery and anesthesiology, to increase the effectiveness of emergency surgery and anesthesiology-resuscitation in critical abdominal and luminal blood loss based on the optimization of intraoperative infusion-transfusion therapy.*

Keywords
controlled clinical trials, instrumental intraoperative blood reinfusion, pleural cavity.

Сравнительная оценка контролируемого клинического испытания аппаратной интраоперационной реинфузии крови, собранной из плевральной полости в условиях медленного и быстрого режимов

Чынгышева Ж.А., Тилеков Э.А., Турдушева Д.К., Турдиев У.М., Назарбеков Д.К., Кубанычбекова А.К.

Кыргызская государственная медицинская академия
им. И.К. Ахунбаева, г. Бишкек, Кыргызская Республика

Автор для корреспонденции:
Чынгышова Ж.А. *- Заведующая кафедрой Анестезиологии и ИТ д.м.н., доцент, Кыргызская государственная медицинская академия им. И.К. Ахунбаева, г. Бишкек, Кыргызская Республика*
E-mail: amanova-j@mail.ru

Аннотация

Цель. *Анализ изучения, в режиме быстрой и медленной эксфузии крови, контролируемые клинические испытания показали, что количество тромбоцитов достоверно снижается.*

Материал и методы. *Нами проведена серия исследований у 44 больных с полостной кровопотерей, что составляет 34,3% от общего числа обследованных больных (n-128), у которых применялась аппаратная технология интраоперционной реинфузии крови (ИО РИК). Исследования также проводились во время операции в первые 2 часа.*

Результаты. *Контролируемые клинические испытания (ККИ) показали, что эксфузия крови после ИО РИК, степени разрушаемости эритроцитов и лейкоцитов при медленной эксфузии крови составляет 35%, а при быстрой – 48%. Осмотическая резистентность снижается в 3 раза.*

Конфликт интересов
Авторы заявляют об отсутствии конфликта интересов

При быстрой аппаратной эксфузии гемолиз крови составляет более 28%, что следует учитывать при выполнении аппаратной интраоперационной реинфузии крови. ККИ показали, что чем быстрее выполнена аппаратная эксфузия, тем значительнее снижение содержания белка и билирубина. В крови, собранной в режиме быстрой аппаратной эксфузии отмечается более высокая концентрация К+, остаточного N и мочевины. ККИ показали, что количество тромбоцитов достоверно снижается, особенно при использовании быстрого режима сбора крови. На таком фоне процесс агрегации достоверно замедляется, причем при быстром режиме сбора крови - в 2 раза в сравнении с контролем. Время рекальцификации плазмы достоверно уменьшается на 40% при использовании высокоскоростного режима сбора крови в сравнении с контрольными показателями, что почти в 3 раза выше, чем при применении медленной аспирации крови.

***Заключение.** В статье дано анализ научных изысканий, ККИ, экспериментального контроля, клинического контроля и практической работы. Работа имеет междисциплинарный характер, написана на стыке хирургии и анестезиологии, повысить результативность экстренной хирургии и анестезиологии-реаниматологии при критических полостных и просветных кровопотерях на основе оптимизации интраоперационной инфузионно-трансфузионной терапии.*

Ключевые слова
контролируемые клинические испытания, аппаратная интраоперационная реинфузия крови, плевральная полость

Баяу және жылдам режимдер жағдайында плевра қуысынан жиналған қанның аппараттық интраоперациялық реинфузиясының бақыланатын клиникалық сынамасын салыстырмалы бағалау

Чынгышева Ж.А., Тилеков Э.А., Турдушева Д.К., Турдиев У.М., Назарбеков Д.К., Кубанычбекова А.К.

И.К. Ахунбаева атындағы Қырғыз мемлекеттік медицина академиясы,
Бішкек қ., Қырғыз Республикасы

Хат алысатын автор:
***Чынгышова Ж.А.** - Анестезиология және ИТ кафедрасының меңгерушісі, медицина ғылымдарының докторы, доцент.,*
И.К. Ахунбаева атындағы Қырғыз мемлекеттік медицина академиясы, Бішкек қ., Қырғыз Республикасы
E-mail: amanova-j@mail.ru

Аңдатпа

***Мақсаты.** Қанның жылдам және баяу эксфузиясы режимінде жүргізілген зерттеуді талдау, бақыланбалы клиникалық зерттеулер тромбоциттер санының айтарлықтай азайғанын көрсетті.*

***Материал және әдістер.** Біз қуыстық қан жоғалтуы бар 44 науқаста бірқатар зерттеулер жүргіздік, бұл тексерілген науқастардың жалпы санының 34,3%-ы (n-128), олар интраоперациялық қан реинфузиясының аппараттық технологиясын (ИО ҚРАТ) пайдаланды. Алғашқы 2 сағатта операция кезінде де зерттеулер жүргізілді.*

***Нәтижелер.** Бақыланбалы клиникалық сынамалар (БКС) ИО ҚРАТ-тан кейін қанның эксфузиясы, қанның баяу эксфузиясы кезінде эритроциттер мен лейкоциттердің жойылу дәрежесі – 35%, ал жылдам қан эксфузиясы кезінде 48% екенін көрсетті. Осмостық төзімділік 3 есе азаяды. Жылдам аппараттық эксфузия кезінде қанның гемолизі 28%-дан асады, бұл аппараттық интраоперациялық қан реинфузиясын жүргізу кезінде ескерілуі керек. БКС аппараттық эксфузия неғұрлым жылдам орындалса, ақуыз мен билирубин мөлшерінің азаюы соғұрлым жоғары болатынын көрсетті. Жылдам аппараттық эксфузия режимінде жиналған қанда К+, қалдық N және несепнәрдің жоғары концентрациясы байқалады. БКС тромбоциттер санының айтарлықтай азайғанын көрсетті, әсіресе жылдам қан жинау режимін пайдаланған кезде байқалды. Осының аясында агрегация процесі айтарлықтай баяулайды, ал қан алудың жылдам режимінде - бақылаумен салыстырғанда 2 есе баяулайды. Бақылау мәндерімен салыстырғанда жоғары жылдамдықты қан жинау режимін пайдаланған кезде плазманы қайта кальцификациялау уақыты айтарлықтай 40%-ға қысқарады, бұл қанның баяу аспирациясын пайдаланған кездегіден 3 есе дерлік жоғары.*

***Қорытынды.** Мақалада ғылыми зерттеулер, БКС, эксперименттік бақылау, клиникалық бақылау және практикалық жұмыстарға талдау жасалған. Жұмыс интраоперациялық инфузионды-трансфузионды терапияны оңтайландыру негізінде қуыстық мен жарық аралық қан жоғалту кезінде жедел хирургиялық және анестезиологиялық-реаниматологиялық тиімділігін арттыру мақсатында хирургия мен анестезиологияның тоғысында жазылған пәнаралық сипатқа ие.*

Мүдделер қақтығысы
Авторлар мүдделер қақтығысының жоқтығын мәлімдейді

Түйін сөздер
бақыланбалы клиникалық сынамалар, аппараттық интраоперациялық қан реинфузиясы, өкпеқап қуысы

According to a number of authors, a decrease in fibrinogen and the number of platelets is apparently connected with their consumption during clotting in the cavity, and partly - with destruction in the aspiration system [2-4, 5-7, 9-10]. Meanwhile, an increase in thromboplastic activity, probably, on the one hand, is a consequence of the ingestion of tissue factors from the tissues damaged during the intervention into the collected blood, and on the other hand, it may be the result of hemolysis [1, 8-10].

An extensive experience in the use of intraoperative blood reinfusion (IOBR) apparatus has been accumulated in the national surgical practice. Kobzeva E.N. (2002) has developed a differentiated tactics of intraoperative fractioning of cavity and wound autoblood [6]. Kobzeva E.N. notes that the electronic microscopic studies of Nunaeva E.S. (1997) showed that erythrocytes used for IOBR have a method of apparatus processing, have normal structural and functional properties, which makes them capable of full functioning after IOBR [6].

Purpose

Comparative characteristics of the results of the following studies performed from the perspective of the controlled clinical trials (CCT):

1) experimental control (EC) - examination of the blood collected from the pleural and abdominal cavities before and after instrumental intraoperative blood reinfusion (IOBR) in conditions of simulating injuries to the abdomen and chest in animals with the corresponding formation of hemothorax and hemoperitoneum;

2) clinical control (CC) - examination of the blood collected from the abdominal and thoracic cavities before and after an IOBR apparatus in patients with injuries and wounds of the chest and abdomen with the corresponding formation of hemothorax and hemoperitoneum.

Material and methods

We have conducted a series of researches in 44 patients with cavitary blood loss, which is 34.3% of the total number of the examined patients (n-128), for whom an IOBR apparatus technology was used. The studies were also conducted during the surgery in the first 2 hours. The breakdown into clinical groups is shown on Table 1. As shown on Table 1, rapid mode of collection of the outflowing blood was used in 18 (40.9%) patients (group A), and slow mode (group B) was used in 26 (59.1%) patients. Moreover, 18 patients represented the clinical group for evaluation of physical-chemical state of the blood from the pleural cavity, while 26 - from the abdominal cavity.

Table 1.
Clinical groups for evaluation of physicochemical state of the blood collected from the abdominal and pleural cavity (A, B), as well as evaluation of the effectiveness (C, D) of IOBR in conditions of rapid and slow blood collection for IOBR (n-44)

Groups	Clinical control	n,%
Blood suitability evaluation		
A	Evaluation of physicochemical state of blood aspirated from the pleural and abdominal cavities in a slow mode	18 40,9%
B	Evaluation of physicochemical state of blood aspirated from the pleural and abdominal cavity in a rapid mode	26 59,1%
IOBR effectiveness evaluation		
C	Evaluation of the effectiveness of IOBR against the background of slow exfusion of blood from the cavities	26 59,1%
D	Evaluation of the effectiveness of IOBR against the background of rapid exfusion of blood from the cavities	18 40,9%

*IOBR – intraoperative blood reinfusion
CC – clinical control

OBR effectiveness evaluation was conducted in all 44 patients in whom the blood from the cavities was collected in various modes. Moreover, under the conditions of rapid mode (group C), the evaluation was conducted in 18 (40.9%) patients, and under the conditions of slow mode (group D) - in 26 (59.1%) patients.

We have developed the simplest apparatus IOBR technique. The device consists of a programmable time relay connected to a micro-vibration compressor and a suction unit. The compressor has knobs for adjusting the degree of vacuum generation. The compressor, from its part, is connected to a sealed, graduated sterile blood collection container.

The device works as follows: the free end of the line is connected to the tip, with a help of which the surgeon aspirates the blood that has poured into the chest or abdominal cavity during the surgery. The specified modification consists in the fact that a calibrated siliconized vessel with a capacity of 1000 ml and connected to a vacuum aspirator is used to collect blood.

The aspirated blood flows into a graduated reservoir with a blood stabilizer. For general practice, we recommend using the traditional TSIPK ampoule with TSOLIPK-7b. When using modern disposable systems for intravenous infusion, blood is sufficiently reliably filtered and returned by gravity into the patient's vein.

Results and discussion: Table 2 shows the dynamics of the morphology of the blood collected from the chest cavity at slow (1st group) and rapid (2nd group) modes.

Table 2.
Parallels of clinical control (CC) and experimental control (EC) of hemographic parameters at different blood aspiration for IOBR

Control	Indicators	Baseline	1st group	2nd group
CC	Er.	3,3±0,8	2,8±0,2*	2,3±0,3*,**
	CI	0,7±0,02	0,5±0,02	0,5±0,04*
	Hb	66,2±5,5	54,4±2,8*	51,0±2,2*,**
	Ht	32,2±2,2	31,5±2,2*	29,5±2,1*,**
	Leuk.	4,8±0,2	4,2±0,1*	4,2±0,2*
EC	Er.	3,5±0,3	2,8±0,1*	2,2±0,2*,**
	CI	0,8±0,01	0,6±0,01	0,5±0,02*
	Hb	98,6±7,4	80,1±3,6*	56,3±5,5*,**
	Ht	30,2±3,1	20,2±2,0*	14,8±2,2*,**
	Leuk.	6,6±0,4	3,4±0,2*	2,5±0,1*,**

Note: * - reliable in comparison with baseline level;
** - reliable in comparison with the 3rd group

As shown on Table 1, in both EC and CC, the number of Er. in the 2nd group decreases more significantly than in the 1st group (P <0.05). In CC and EC, similar dynamics are observed for CI, Hb, and Ht. The value of all indicators of hemogram in the 2nd group is reduced in comparison with those of the 1st group. Thus, for example, in EC, the Ht indicator in the 4th group is 2 times less than the baseline value (P <0.05). In CC, the gradient of the decline in this indicator is slower, but the trend remains as in EC. That is, in the 2nd group it is more noticeable than in the 1st group. According to EC data, the number of leukocytes decreases in the 1st group by almost half, and in the 2nd group - almost threefold (P <0.05 and P <0.05). According to CC, the decrease in leukocytes in the 1st and 2nd groups respectively is 0.8 times.

Table 3 shows the physical-colloid characteristics of the blood collected from the chest cavity, depending on the speed of its apparatus exfusion (slow and rapid modes).

Table 3.
Parallels of clinical control (CC) and experimental control (EC) of physicoloid parameters at different blood aspiration rates for IOBR

Control	Indicators	Baseline	1st group	2nd group
CC	Osm. resist. Er. (%)	0,8±0,01	0,7±0,01*	0,3±0,02*
	Hemolysis,% to total Hb	3,1±0,4	8,2±0,02*	10,8±0,3*,**
	Free Plasma Hb, mg%	1,0±0,01	6,6±0,6*	10,4±1,0*,**
EC	Osm. resist. Er. (%)	0,8±0,003	0,6±0,02*	0,4±0,02*
	Hemolysis,% to total Hb	6,3±0,3	8,8±0,07*	12,3±1,2*,**
	Free Plasma Hb, mg%	3,3±0,03	7,7±1,1*	31,2±2,5*,**

Note: * - reliable in comparison with baseline level;
** - reliable in comparison with the 3rd group

As shown on Table 3, in EC, osmotic resistance of erythrocytes during apparatus exfusion decreases: in the 1st group - by 1.5 times, and in the 2nd group - by 2 times (P <0.05 and P <0.05). The specific gravity of free plasma Hb significantly and sharply increases in both groups (P <0.05). Meanwhile, in a comparative aspect, the increase in free Hb in CC is less pronounced than in EC.

Thus, in EC, blood hemolysis with a slow mode of exfusion (group 1) is 8.8 ± 0.07%, and in the 2nd group - 12.3 ± 1.2% (P <0.05 and P < 0.05). In CC, 8.2 ± 0.02% and 10.8 ± 0.3% (P <0.05 and P <0.05) respectively.

Thus, the specific gravity of destruction of the blood corpuscles during rapid mode of apparatus blood exfusion reaches 48% in EC and 35% in CC.

Table 4 shows the dynamics of the content of protein and its fractions in blood collected from the pleural cavity for IOBR at slow (1st group) and rapid (2nd group) modes.

Table 4.
Parallels of CC and EC of proteinogram indicators at different blood aspiration rates for IOBR

Control	Indicators	Baseline	1st group	2nd group
CC	Protein	54,2±6,6	50,2±2,2*	43,2±2,0*,**
	Albumen	30,2±6,2	42,5±2,3*	32,8±6,6
	Globulin	42,5±2,2	58,8±2,5*	55,3±3,8*
	A/G ratio	1,0±0,05	0,7±0,01*	0,6±0,05*,**
EC	Protein	59,2±4,1	53,4±3,3*	41,6±5,1*,**
	Albumen	41,4±3,9	40,0±5,1*	33,5±2,8
	Globulin	59,2±8,1	59,4±4,4*	65,9±3,6*,**
	A/G ratio	0,7±0,01	0,6±0,01*	0,5±0,05*,**

Note: * - reliable in comparison with baseline level;
** - reliable in comparison with the 1st group

As shown on Table 4, in EC, the decrease in the concentration of the total protein, as well as its albumin fraction, is more pronounced in the 2nd group (P <0.05 and P <0.05). In CC the situation is the same (P <0.05 and P <0.05). Such dynamics is also typical for the albumin content, both in EC and CC. Moreover, the gradient of the decrease in this fraction of protein in plasma is more pronounced in the 2nd group, that is, during rapid mode of aspiration of cavity blood (P <0.05 and P <0.05).

Table 5 shows the dynamics of a number of biochemical parameters of the blood collected from the chest cavity at slow (1st group) and rapid (2nd group) collection modes.

Table 5.
Parallels of clinical control (CC) and experimental control (EC) of biochemical parameters at different blood aspiration rates for IOBR

Control	Indicators	Baseline	1st group	2nd group
CC	Bilirubin	15,3±2,4	18,8±1,2*	21,5±2,2*,**
	Residual N	19,3±1,01	28,2±1,5*	33,4±2,1*,**
	Urea	4,8±0,4	25,8±2,6*	36,2±2,0*,**
	Na^{++}	140,2±5,5	142±2,2	145±3,1
	K^{+}	4,1±0,2	5,0±0,1*	5,0±0,3*
EC	Bilirubin	5,2±0,3	5,6±0,4	5,2±0,1
	Residual N	31,4±9,2	33,6±2,3*	56,2±6,2*,**
	Urea	8,2±0,9	23,6±251*	66,7±7,7*,**
	Na^{++}	144,5±3,8	136±8,8	144±5,9
	K^{+}	5,1±0,3	5,3±0,1*	5,9±0,3*,**

Note: * - reliable in comparison with baseline level;
** - reliable in comparison with the 1st group

As shown on Table 5, in EC, the concentration of bilirubin is practically the same in the compared groups, while the residual N and blood urea increased several times in comparison with the baseline values (P <0.05 and P <0.05). Moreover, in the 2nd group, a similar tendency is more pronounced than in the 1st group.

In CC, there is a tendency to an increase in the concentration of bilirubin. In particular, in the 1st group up to 18.8 ± 1.2 mmol/L and in the 2nd group - up to 21.5 ± 2.2 mmol/L (P <0.05 and P <0.05). Such dynamics is also typical for the content of the residual N and urea. By the way, the trend towards hyperkalemia is more pronounced for EC.

Discussion. Based on the extended hemostasiogram of the blood collected from the chest cavity, depending on the rate of apparatus blood exfusion (slow and rapid modes of aspiration) in EC, we found that

the number of platelets in EC significantly decreases in both groups (P <0.05 and P <0.05). Moreover, in the 2nd group, this process is more pronounced than in the 1st group. Similar dynamics and regularity are also characteristic of platelet aggregation and adhesion (P <0.05 and P <0.05).

Thus, during rapid apparatus collection, the blood clotting process increases. This is evidenced by the fact that in EC there is a more rapid rate of shortening of Lee-White coagulation time in siliconized and non-siliconized trial tubes. It should be noted that in the 2nd group this fact is noticeable more clearly.

In the 2nd group, the plasma recalcification time decreases by almost 2 times in comparison with the baseline level (P <0.05), and the kaolin and kaolin-cephalin time of plasma - > 2 times (P <0.05 and P <0.05), making, respectively, 30.1 ± 1.9 sec (against the baseline value - 64.4 ± 3.8 sec) and 25.5 ± 1.0 sec (against the baseline value - 62.4 ± 8.8 sec).

In both groups, there was a synchronous shortening of thrombin and prothrombin times (P <0.05 and P <0.05). Moreover, the same regularity remains as was the case with respect to the time of blood coagulation. That is, in the 2nd group, the dynamics of the shortening of time is more pronounced than in the 1st group. Moreover, the prothrombin time is shortened more rapidly than the thrombin time.

Against this background, the content of fibrinogen in both groups increases. In particular, in the 1st group - up to 2.4 ± 0.3 g/L and in the 2nd group - up to 3.1 ± 0.2 g/L versus the control value - 1.9 ± 0.2 g/L (P <0.05 and P <0.05). It was found that the duration of euglobulin fibrinogen also increased (P <0.05). Meanwhile, in all periods of the ACT reactions (6, 8 and 10 minutes), on the contrary, they are shortened. Especially, this process is noticeable in the 2nd group (P <0.05).

On the basis of the extended hemostasiogram of blood collected from the chest cavity, depending on the rate of apparatus blood exfusion (slow and rapid modes of aspiration) in CC we found that in the compared groups there was a synchronous decrease in the number of platelets, as well as their aggregation and adhesion (P <0.05 and P <0.05). In both 1st and 2nd groups, a shortening of thrombin and prothrombin times is observed.

It should be noted that such a synchronicity and such a pattern persists in relation to the time of blood coagulation. Moreover, a certain synchronicity is manifested in EC and CC.

Thus, in CC and EC, it is noticeable that in the 2nd group the dynamics of time shortening is more intense than in the 1st group. Moreover, in both materials (experimental and clinical), the prothrombin time is shortened more rapidly than the thrombin time.

As for the concentration of fibrinogen, in the compared groups it clearly increases, both according to EC data and according to CC data. In particular, in EC in the 1st group, fibrinogen increases to 2.4 ± 0.3 g/L, and in the 2nd group - to 3.1 ± 0.2 g/L versus the control value - 1.9 ± 0.2 g/L (P <0.05 and P <0.05).

In CC, the indicators are 2.6 ± 0.2 g/L and 3.3 ± 0.6 g/L, respectively (P <0.05 and P <0.05). Simultaneously with this process, the duration of euglobulin fibrinogen (P <0.05) also increases in both research materials. It was found that the ACT reaction (6, 8 and 10 min) are shortened during all periods, especially in the 2nd group - 2 times in average (P <0.05).

Conclusion

Starting the conclusion, it should be noted that the results of systematization of long-term and multifaceted scientific and practical data provide the ground for classification of the problem of emergency blood replacement in cases of intraoperative bleeding (cavity, luminal) as a poorly structured subject area. This is due to the fact that, as a rule, new methods are applied to new research objects at different stages of research.

These methods often belong to different methodological clusters. We mean the use of experimental, clinical, statistical, probabilistic studies, each method of which has its own interval of abstraction. In this aspect, we believe that the scientific justification of the adapted IO ITT (intraoperative infusion-transfusion therapy) program should be based on the comparative characteristics of the data obtained in the result of using the methods of various methodological clusters (EC, CC, CCI).

One way or another, at some stage of the study of the problem, it becomes necessary to perform a conceptual unfolding of an object in the form of a set of its projection in various methodological clusters.

Taking into account the above, we have put a target to increase the effectiveness of emergency operation and anesthesiology and resuscitation in critical cavity and luminal blood loss based on the optimization of IO ITT. Moreover, the optimization was supposed to be built on the basis of many years of research, which are purely experimental, clinical, statistical, methodological, probabilistic in nature.

First, there is a clear parallel between CC and EC, indicating the relevance of experimental and clinical laboratory research methods;

Second, there is a clear connection between the timing of hemoperitoneum and hemothorax, as well as the nature of changes in the hemostasis system in the blood collected, respectively, from the abdominal and thoracic cavities. The degree of destruction of formed elements in the blood collected from the pleural cavity exceeds the one in the blood collected from the abdominal cavity and, in general, the process of hemolysis of the blood poured into the pleural cavity is more intense than the one in the blood poured into the abdominal cavity.

Third, there is a clear parallel between CC and EC data that the main function of the collected blood – transportation of O2 is preserved to a sufficient extent, regardless of the pleural or abdominal cavity. At the same time, due to the more pronounced hemolytic ability of the pleural cover, the quality of the blood collected from the pleural cavity is inferior to the one of the blood collected from the abdominal cavity.

In our opinion, the results of CCI with determination of the relevance of CC and the effectiveness of IO BRI (intraoperative blood reinfusion) apparatus are in the following evidence:

First, there is a clear parallel between CC and EC, indicating the relevance of experimental and clinical laboratory research methods;

Second, in case of EC after IO BRI, the degree of destructibility of erythrocytes and leukocytes in case of slow blood exfusion is 35%, and in case of rapid blood exfusion is 48%. Osmotic resistance is reduced by 3 times. With rapid apparatus exfusion, blood hemolysis is more than 28%, which should be taken into account when performing the apparatus IO BRI;

Third, the faster the apparatus exfusion is performed, the more significant is the decrease in the protein and bilirubin content both in case of EC and CC. A higher concentration of K+, residual N and urea is noted in the blood collected in the mode of rapid apparatus exfusion;

Fourth, platelet count is significantly reduced, especially when using a rapid blood collection mode. Against this background, the process of aggregation is reliably slowed down, and in case of rapid mode of blood collection - 2 times in comparison with the control. Plasma recalcification time is reliably reduced by 40% when using a rapid blood collection mode in comparison with the control parameters, which is almost 3 times higher than when using the slow blood aspiration;

Fifth, in case of EC, 4 hours after IO BRI using the technology of slow blood exfusion, hemographic and biochemical parameters increase. When using the technology of rapid blood exfusion, the number of platelets decreases and the degree of their aggregation and adhesion decreases.

After IO BRI under the conditions of the given rates of apparatus exfusion of autologous blood, the concentration of K + and Na ++ in the blood plasma increases, and after rapid exfusion - to critical values.

We investigated the limits of justification of the adapted IO ITT program for critical luminal blood loss, depending on the rate of bleeding and the severity of the patient's condition. They demonstrated the following results:

First, in case of profuse bleeding, the proportion of lethality with expectant tactics is 10%, while in case of active bleeding it is 2 times less (5%). At the same time, the proportion of postoperative complications is 4 times lower with active tactics than with active expectant tactics;

Second, against the background of using the adapted ITT program, the chances of a favorable outcome of the operation increase by 30% when using active tactics in patients, and the level of risk of an unfavorable outcome in case of using the expectant tactics is 2 times less (15%);

Third, in a serious condition of patients, the proportion of mortality in case of active tactics is 6.2%, and in case of active-expectant tactics it increases almost 7 times, amounting to 41.6%;

Fourth, against the background of implementation of the adapted ITT program in patients in extremely serious condition and in whom active operative tactics were undertaken, the chances of a favorable outcome of the operation increase by 82%, and the level of risk of an unfavorable outcome in case of using active expectant tactics increases by 15%.

This is what our studies have demonstrated regarding the limits of justification of the adapted IO ITT program for critical luminal blood loss, depending on the massive blood loss and the old age of patients:

First, in patients with the III stage of blood loss and in whom active operative tactics were undertaken, postoperative complications were observed in 25% of patients, while in patients in whom active expectant tactics were undertaken, complications developed in 50% of patients. Moreover, in patients in whom active tactics were undertaken, mortality was observed only in 6.2% of patients, while in patients in whom active expectant tactics were undertaken - in 41.6% of patients;

Second, in patients with the III stage of blood loss and in whom active operative tactics were undertaken, the chances of a favorable outcome of the operation increase by 30%, and the level of risk of an unfavorable outcome in case of using the active-expectant tactics increases by 15%;

Third, in patients with the II stage of blood loss and in whom active operative tactics were undertaken, postoperative complications developed in 10% of patients, whereas in patients with the same degree of blood loss, but operated on in a delayed period, according to their active expectant tactics, complications were noted in 40% of patients. Thus, there is a 4-fold increase in postoperative complications. At the same time, the proportion of mortality in case of active tactics is 10%, while in patients operated on in delayed periods - 5%;

Fourth, in patients with the II stage of blood loss and who underwent the operation in the early stages, the chances of a favorable outcome of the operation increase by 60%, and the level of risk of an unfavorable outcome in case of a delay in the operation increases by 15%;

Fifth, the proportion of mortality in patients at the age of > 60 in case of active surgical tactics is 6.4%, and in case of active-expectant tactics it increases 9 times (57.1%). The proportion of postoperative complications in case of active tactics is 24.3%, and in case of active-expectant - 29.2%. The chances of a favorable outcome in case of active tactics increases by 82%, and the level of risk of an unfavorable outcome in case of active-expectant tactics is 7.5 times less (15%).

References

1. Barash, P.J. Clinical anesthesiology / Barash P.J., Cullen B.F., Stalting R.K. // Transl. from English Ed. Rodionova V.Ya. - M.: Medical literature, 2004. - 592 p.
2. Bogomazova, I.V. Replenishment of intraoperative blood loss in abdominal hysterectomy / Bogomazova I.V. // Abstract of the dis. thesis...Candidate of Medical Sciences. - M., 2005. - 23 p.
3. Buidenok, Yu.V. The strategy of anesthetic management in extended combined surgeries and massive blood loss in oncosurgery / Buidenok Yu.V. // Abstract of the dis. thesis ... Doctor of Medical Sciences. - M., 2005. - 48 p.
4. Vorobiev, A.I. Acute massive blood loss. / Vorobiev A.I., Gorodetsky V.M., Shulutko E.M., Vasiliev S.A. - M.: GOETAR-MED, 2001. - 176 p.
5. Dutkevich, I. G. Pathogenetic substantiation of the principles of transfusion therapy for acute blood loss // Transfusiology. - 2001. - No. 5. - P. 30-40.
6. Kobzeva, E.H. Hardware reinfusion in emergency surgery / Kobzeva E.H. // Abstract of the dis. thesis...Candidate of Medical Sciences. - M., 2002. - 27 p.
7. Khvatov, V.B. Clinical transfusiology in emergency conditions (modern concepts and perspectives) / Khvatov V.B. - M.: SP Research Institute named after. N.V. Sklifosovsky, 2003. - 27 p.
8. Khvichiya, L.O. Algorithm for express diagnostics of the functional state of the hemostasis system / Khvichiya L.O., Korshunov G.V. // Clinical laboratory diagnostics. - 2000. - No. 10. - P. 18-19.
9. Chyngyshova, Zh. A., Chapiev M. B. Clinical and statistical monitoring of an intraoperative incident in the form of critical abdominal blood loss [Kliniko-statisticheskij monitoring intraoperacionnogo incidenta v vide kriticheskoj polostnoj krovopoteri]// International Journal of Applied and Fundamental Research. - Moscow, 2019. - No. 4. - S. 95-97.
10. Chyngyshova, Zh. A., Chapiev M. B. Controlled clinical trial and determination of the relevance of clinical and experimental control of hemographic and physico-colloid parameters of the state of abdominal blood for intraoperative reinfusion [Kontroliruemoe klinicheskoe ispytanie i opredelenie relevantnosti klinicheskogo i jeksperimental'nogo kontrolja gemograficheskih i fizkolloidnyh pokazatelej sostojanija polostnoj krovi dlja intraoperacionnoj reinfuzii] // International Journal of Applied and Fundamental research. - Moscow, 2019. - No. 4. - S. 97-99.