M. Yu. Rykov[1], A. Z. Dzampaev[1], V. G. Polyakov[1,2]

Comparative Analysis of Application of Subclavian Catheters and Implantable Venous Ports in Treatment of Oncologic Diseases in Children

ABSTRACT. Comparative analysis of applying subclavian catheters (SC) and implantable venous ports (IVP) in children with oncologic diseases is conducted. The study testifies to higher prevalence of IVP as compared with SC. We detected that there are less complications and technical difficulties during installation IVP than SC, so they are subject to correction during operations more frequently. The application of subclavian catheters is accompanied by a higher rate of complications and breakdown of protocols of antitumor treatment as compared with IVP.
Keywords: pediatric oncology, implantable venous ports, catheter-associated bloodstream infections, chemotherapy.

INTRODUCTION.

Over the past decades have seen marked success in the treatment of cancer in both children and adults. Survival over 5 years with a number of clinical entities reaches 80 percent or more. This was made possible by the development of effective programs for the integrated treatment in which chemotherapy (CT) played the leading part. [5]

Modern chemotherapy of cancer - a combination of chemotherapy treatment Cyclic (CP) used in sequence with respect to each other administered as an infusion of different duration (from 15 minutes to 24 - 72 hours or more) [15, 17].

Intravenous CP administration method is central to the most cancers is associated with irritation of the vessel wall, flebothrombosis, tissue necrosis, extravasation of drugs. In addition, during chemotherapy require multiple diagnostic fences venous toxicity of treatment to control and monitor the dynamics of the disease, as well as I / maintenance infusion therapy [16, 18].

The use of peripheral veins because of their small diameter, low blood flow, shortest path for bacteria contaminated surface of the skin to the vessel lumen, high probability of chemical thrombophlebitis and extravasation is unacceptable for continuous infusion and repeated administration of the chemotherapeutic drugs [4, 7, 8].

The use of central venous access avoids most of the problems mentioned above. However, central venous catheterization (CVC) associated with a risk of severe complications, such as during catheterization and at catheter operation. The most formidable of them are

catheter infection, sepsis, air embolism. In addition, the presence of an external central venous catheter (CVC) are inevitable discomfort and difficulty in carrying out hygiene procedures. With many months of continuous chemotherapy require repeated catheterization CV, which lead to the growth of related complications [1, 2, 3, 5, 7, 22].

Implantable venous port system (IVP) possess significant advantages compared with the above-described venous access because it does not subject to any external influences, do not cause discomfort to the patient and does not limit their locomotor activity, which is important in pediatrics. Port - a small container - chamber having at the top of the silicone membrane through which a special needle puncture performed for infusion. In the lateral part of the chamber connected catheter, the other end of which is placed in the superior vena cava (SVC). The camera is sutured to the soft tissue of the subclavian region [6, 19, 22].

IVP was invented in 1988 in the United States by Dr. R.T. Woodburn and patented his August 29, 1989 [11]. Puncture camera port can be used only special, not cutting, Huber needle, excluding damage silicone membrane [6, 10, 22].

The aim of the study: minimization of complications during chemotherapy in children with cancer and improving the quality of life.

MATERIALS AND METHODS

Four hundred and twenty-eight pediatric oncology patients underwent placement of a central venous access device between 2010 and 2014. 210 patients (48.2%) underwent subclavian catheter (SC) insertion, and 218 (51.8%) patients – IVP implantation (Table 1).

Both groups were comparable by age, nosological entity distribution and prevalence, and treated according to similar strategies within the same time period.

Venous access system locking between infusions was carried out with a 100 IU/ml heparin solution and a special solution containing 3 ml of taurolidine. In case of catheter thrombosis in the central venous access system, 3 ml of 500 IU/ml Urokinase (solution was introduced with a 15 minute exposition.

Statistical analysis. The statistical analysis was carried out on a personal computer with the help of STATISTICA 7.0 (StatSoft, USA). A χ^2 test and Fisher's exact test were used to assess the statistical significance of the differences. The threshold p-value for statistical significance was 0.05.

RESULTS.

The main results of venous access system implantation and use are given in table 2.

In this retrospective study of 428 pediatric oncology patients insertion of a subclavian

venous catheter resulted in more complications (98.3%) when compared to insertion of a venous port (37.3%) ($p<0.01$). The most frequent complications during insertion of a subclavian vein catheter were difficulty with vein puncture and accidental catheterization of subclavian artery,
Procedural complications were more likely (89% vs. 34%; $p<0.01$) to be managed intraoperatively during insertion of a port compared to insertion of a subclavian venous catheter.
Late complications that occurred during use of a subclavian catheter (97.3%) were significantly higher ($p<0.01$) compared to venous ports (22.9%). Catheter thrombosis rates were higher for subclavian catheters (35.4%) compared to venous ports (5.0%). Catheter infection rates were higher for subclavian catheters (55.7%) compared to venous ports (2.5%) ($p<0.001$). Taurolidine was not used to lock central venous catheters and this may account for the higher rate of central venous catheter-related infections (73 patients; 12%).
The complications during venous ports and subclavian catheters led to treatment protocol deviation in only 1.7% of patients with an IVP and in 45.9% of patients with a SC ($p<0.01$).

DISCUSSION

Our study confirms the benefits of IVP than SC. Ports used both for chemotherapy and supportive care, as well as for general anesthesia during surgical treatment stages, the introduction of x-ray contrast agents and palliative care, once established for the whole period of treatment and follow-up. SC often installed (905 catheters 210 patients), which was caused as a limited lifespan, and a lot of complications.
It is shown that the use IVP at children with cancer significantly reduces the number of complications both during installation and during use when compared with other possible options. Another important advantage - reducing the amount of general anesthesia and the load on the medical staff. The developed technique of implantation of these devices using ultrasound and X-ray equipment reliability and safety.

An important aspect in the conditions of modern economic realities - the cost of treatment. We found that, although the price of IVP is higher than the price of SC, extensive use of the latter is more than 2 times costly, given the cost of diagnosis and treatment of intraoperative complications and performance. This difference is maintained even considering installation costs IVP children with general anesthesia.

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Table 1 – General parameters of the material.

PARAMETER	VENOUS ACCESS	
	SC	IVP
Years	2010 – 2014	2010 – 2014
Number of patients	210 (49%)	218 (51%)
Gender of the patients	Male 118 (56.2%) Female 92 (43.8%)	Male 121 (55.5%) Female 97 (44.5%)
Age	3 months – 17 years	6 months – 17 years
Mean age	8.1 years	11.5 years
Total number of implanted venous access systems	605	118

Table 2 – Comparative analysis of complications during implantation and use of SCs and IVPs.

PARAMETERS	VENOUS ACCESS	
	SC	IVP
QUANTITY	905	218
Intraoperative complications/ complications coped with intraoperatively	98.3% / 33.7%	37.3% / 88.6%
Complications during use	97.3%	22.9%
Thrombotic occlusion of venous access systems/ thrombotic occlusion coped with intraoperatively	35.4% / 63.5%	5% / 100%
Contamination	55.7%	2.5%
Removal by patients	28.9%	0
Complications resulting in treatment protocol deviation	45.9%	1.7%

Maxim Yurievich Rykov, PhD, researcher at the Department of tumors of the musculoskeletal system FSBSI "N.N. Blokhin RCRC" Address: 115478, Moscow, Kashirskoe sh., 24, tel .: + 7-916-187-52-61e-mail:wordex2006@rambler.ru.

Aslan Zelimhanovich Zampaev, PhD, Head of the Department of tumors of the musculoskeletal system FSBSI "N.N. Blokhin RCRC" Address: 115478, Moscow, Kashirskoe sh. 24, e-mail:dzampaev@list.ru.

Vladimir Georgievich Polyakov, Academician, MD, Professor, Deputy Director of the Institute

of Pediatric Oncology and Hematology FSBSI " N.N. Blokhin RCRC", head of the department head and neck tumors Institute of Pediatric Oncology and Hematology FSBSI "N.N. Blokhin RCRC", head of the Department of Pediatric Oncology GBOU DPO RMAPO Health Ministry, chief pediatric oncologist Health Ministry. Address: 115478, Moscow, Kashirskoe sh. 24, e-mail: vgp-04@mail.ru.