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Skuteczność profilaktyki przeciwzakrzepowej po endoprotezoplastyce stawu biodrowego

Streszczenie

Wstęp. Staw biodrowy często ulega zmianom zwyrodnieniowym, które znacznie ograniczają jego czynność i zmniejszają ogólną sprawność fizyczną chorego. Obecnie najczęstszym sposobem leczenia zaawansowanych zmian zwyrodnieniowych stawu biodrowego jest jego wymiana na sztuczny. Niestety zabieg i okres okołooperacyjny sprzyja powstawaniu żylnych zmian zakrzepowych.

W Polsce rocznie na żylną chorobę zakrzepowo-zatorową zapada ok. 80-100 tys. osób, w jednej trzeciej pod postacią zatorowości płucnej, a w dwóch trzecich „czystej" choroby zakrzepowej żył. Zastosowanie skutecznej profilaktyki tego groźnego powikłania zależy od znajomości klinicznych czynników ryzyka stwierdzonych podczas wywiadu przeprowadzonego indywidualnie z każdym pacjentem.

Cel. Celem pracy była ocena sprawności przepływu krwi w kończynach dolnych osób poddanych systematycznym ćwiczeniom przeciwzakrzepowym oraz standardowemu tokowi usprawniania leczniczego po wszczepieniu endoprotezy stawu biodrowego.

Materiał i metody. Oceny stanu funkcjonalnego naczyń żylnych u 36 kobiet i 24 mężczyzn dokonano na podstawie badania ultrasonograficznego i pomiaru obwodu kończyn dolnych na poziomie stawu skokowego oraz goleni.

Wyniki. W wyniku przeprowadzonej analizy statystycznej stwierdzono, że po zabiegu prędkość maksymalna-skurczowa uległa istotnej poprawie jak również istotnie statystycznie poprawiła się prędkość minimalna.

Wnioski. Badania wykazały korzystny wpływ wczesnego wprowadzenia ćwiczeń przeciwzakrzepowych i leczenia fizjoterapeutycznego na przepływ krwi w żyłach kończyn dolnych.

Słowa kluczowe: endoproteza stawu biodrowego, żylna choroba zakrzepowo-zatorowa, profilaktyka przeciwzakrzepowa, badanie ultrasonograficzne, pomiary obwodów.

The effectiveness of thromboprophylaxis after the total hip replacement

Abstract

Introduction. The hip joint often undergoes degenerative changes that significantly reduce its activity and the overall fitness of a patient. Currently, the most common treatment for advanced osteoarthritis of the hip joint is replacement surgery. Unfortunately, the treatment and perioperative period cause the development of venous thrombosis.

In Poland about 80-100 thousand people a year are diagnosed with venous thromboembolic disease, one third in the form of pulmonary embolism, and two thirds of "pure" venous thrombosis. The use of efective prevention of this serious compliction depends on the knowledge of clinical risk factors identified during an interview with each patient individually.

Aim. The aim of this study was to evaluate the efficiency of blood flow in patients undergoing lower limb systematic antithrombotic exercises and standard course of the therapeutic improvement after the hip replacement.

Material and methods. Evaluation of the functional status of veins in 36 women and 24 men was based on ultrasound examination and measurement of the circumference of the leg at the ankle and shin.

Results. As a result of statistical analysis it was found that after the surgery, the maximum systolic velocity improved significantly and also the minimum velocity significantly improved statistically.

Conclusions. Studies showed a beneficial effect of an early introduction of anticoagulant exercises and physiotherapeutic treatment on blood flow in the veins of the lower limbs.

Keywords: hip replacements, venous thromboembolism, prophylaxis, ultrasound examinations, measurements of circumference.

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INTRODUCTION

With the development of civilization and longer human life, arthritis began to be the main problem of orthopedics. The hip is particularly vulnerable to the occurrence of such changes resulting primarily from mechanical wear of its surface [1]. Regardless of the etiology of coxarthrosis, also inflammatory (rheumatoid arthritis), pathological changes relate primarily to the articular cartilage [2]. According to the definition given in 1995 by Goldberg and Keutner the degenerative disease is the result of both biological and mechanical events that destabilize the interrelated processes of degradation and synthesis of articular cartilage [3]. Clinically, this condition manifests itself primarily with pain around the hip joint, decreased range of active motion and impaired social and vocational patient's activity [4]. With time, the intensification of pain symptoms and the occurrence of the limitation in the range of motion decrease the quality of life. In the advanced disease process the arthroplasty is the definitive treatment, which is now considered a standard procedure. The surgery and properly conducted rehabilitation provide good results, recovery of muscle strength, restored large range of motion and relief of pain [5].

From the first day after the surgery widely understood in terms of improving the prevention of venous circulation should be introduced. Implementation of such a procedure avoids complications and allows further improvements. Extensive orthopedic procedures performed on the hip or in the site of a small pelvic predispose to the formation of clots in the veins of the lower limbs [6].

Deep vein thrombosis and related complications (pulmonary embolism, chronic venous insufficiency of lower limbs) are currently the most prevalent diseases of people over 45 years of age and over 90% of blood clots are in the deep veins of lower limbs [7]. Despite progress in prevention, diagnosis and treatment of venous thromboembolism, its incidence increases [7,8]. It is determined most likely by the prevalence of risk factors for venous thromboembolism. It is very important to be familiar with them since this knowledge is the first step to evaluate the degree of risk associated with specific clinical situations [9].

The risk factors of venous thromboembolic disease can be divided into four groups. General factors, which include age and immobilization (bed rest), immobilization of a limb (e.g., caused by plaster, paresis), vascular veins, phlebitis and venous thrombosis in the interview and the "collapse" of popliteal vein during prolonged sitting position (so-called "flight clot"). Heart failure, heart attack and stroke also foster the embolization. Factors caused by surgical intervention include surgeries, especially hip replacement of large joints such as hip (incidence of the embolism 1 to 0.5% in case of perioperative prophylaxis) and the knee joint [9-11].

The most common place of thrombosis are deep vein of the calf. The thrombus which gradually accrues at the site may spread to the popliteal and femoral vein [12]. Calf vein thrombosis in over 50% of patients is almost asymptomatic, which makes it difficult to diagnose and it increases the risk of serious complications [13]. Usually, the first alarming symptom is a severe dull pain of medial side of the calf, the knee area or plexus gastrocnemius muscle vein. The pain is increased in the upright position and disappears while lying down, especially after lifting the limb. The increased warming of the surrounding skin is often observed, which gradually becomes strained and bruised [6].

The purpose of thromboprophylaxis in surgical patients is to prevent venous thromboembolism. It has long been known that physical exercise is beneficial for the increase of the level of antithrombin III, which is a natural inhibitor of coagulation, and a deficiency of physiological inhibitors of coagulation and thrombocytosis favor the embolism [7]. The factors of specific increase in the risk of thromboembolism are major orthopedic surgeries.

Correctness of applied prophylaxis must take into account the general risk factors of the venous thromboembolic disease [9], which often reduces the likelihood of thromboembolic complications [10,11]. The effectiveness of the prevention also depends on inference from data of a detailed interview on admission and physical examination including the visual inspection, palpation, vascular tests and measurement of limb circumference [14,15]. In addition to the above examinations it is necessary to perform basic laboratory tests, in particular, accurate assessment of the coagulation system [16,17].

The combined kinesitherapy and physiotherapy improvement (controlling pain, maintaining or improving the range of joint mobility, decreasing a muscle reflex and their strengthening) shortens the period of a hospital stay, is beneficial to their mental state, and consequently improves their quality of life [18].

AIM

The aim of this study was to evaluate the parameters of venous blood flow of the lower limbs in men and women after hip replacement surgery. It was assumed that the early initiation of anticoagulation physiotherapy improves venous blood flow parameters. The study was designed in such a way as to be able to answer the following research questions:

1. What are the venous blood flow parameters V max [m, s], V min [cm, s] before and after implantation of a hip replacement?
2. Did anticoagulation physiotherapy which was immediately applied after orthopedic surgery, reduce the risk of venous thromboembolism?
3. What are the values of blood flow in different age ranges (up to 59, 60-69, above 70) before and after surgery?

MATERIALS AND METHODS

Evaluation of blood flow in veins in patients after a hip replacement surgery was based on an ultrasound scanning of 3.5 MHz made using a camera Loqic 500 (General Electronic Medical System) with the possibility of imaging blood flow in the form of the curve flow (duplex Doppler) and measurement of the circumference of a tarsal-shin joint and a thigh.

Doppler ultrasound examination was conducted at the Department of Interventional Radiology and Neuroradiology, Medical University of Lublin. Sixty patients aged 40 to 87

years (average age: 63.5) were examined. The patients were surgically treated at the Department of Orthopedics and Rehabilitation, Medical University of Lublin. The diagnostic tests included:

1. Ultrasound scan (duplex Doppler) for the assessment of venous blood flow dynamics in the course of femoral vein,
2. Measurement of the circumference of the lower limb of the operated and not operated leg measured at the widest point (measurement of triceps of the calf),
3. The circumference of the ankle of the lower operated and not operated limb measured at the ankle on both shins.

Each patient was interviewed to confirm or reject the risk factors of venous blood flow changes.

All patients were asked about:

- Smoking,
- Hypertension,
- Obesity,
- A history of past myocardial infarction,
- A history of past stroke,
- Diabetes,
- Occurrence of lower limb pain,
- Type of occupation,
- Past major surgeries, immobilization or restriction of physical activity,
- Use of hormonal drugs.

Evaluation of venous blood flow in the same patients was performed twice: a day before the surgery (Examination I), after fourteen cycle of the therapeutic treatment (Examination II).

All patients had the uniform physiotherapy including anticoagulant prophylaxis.

The following were used:

- Passive methods, such as leg elevation, repeated shin compression;
- Active methods such as: passive movements in the ankle – tibial, active movements of the limbs in the form of rhythmic movements of plantar flexion and extension in the ankle joints, and early mobilization of patients. Isometric exercises of a lower limb muscles were used, active and active with opposition of the lower limb which was not operated, then active – assisted practice and active of operated limb. Tilting and learning to walk with the aid of a walker, and later walking therapy using elbow crutches.
- Pharmacological methods.

The entire period of treatment and stay in the Department of Orthopedics and Rehabilitation lasted about 3 weeks. All circumference measurements were made according to rules specified by Zembaty [19]. In order to eliminate the error in the measurement the study was performed on a medical couch in the back lying position. The therapist evaluated the difference in circumference of the operated and not operated leg beginning with a healthy site. When testing the circumference on the second limb one had to move a selected distance first and then take a measurement. The ultrasound assessment of blood flow in veins was completed in a patient lying on the back with the operated leg bent at the hip, knee and a foot based on the couch. The probe was placed in the groin area at the entry point of both femoral vein and the transverse and longitudinal projection. The measurement was performed at the time of the free respiratory rhythm. The following parameters of femoral venous blood flow were specified:

- Maximum velocity – systolic [V max],
- Minimal velocity – end – diastolic [V min],
- Indicator (index) resistant – [RI],
- Vein diameter [d].

Resistive index [RI] was calculated by dividing the difference of maximal velocity [V max] and the end – diastolic velocity [V min]. Min and max velocity, RI, and vein diameter [d] were calculated automatically by the ultrasound apparatus.

RESULTS

The results of the study as a comparison of the average of the two phases were analyzed using the U Mann-Whitney test, having regard to the average, standard deviation. The significance of differences between the results was determined at the level $p<0.05$. A group of 60 patients included 60% women and 40% men. Average age was 63.5±10.87 years old (range from 40 to 87 years old). Patients at the age of 60 accounted for 38.33%, while at the age from 60 to 69 years old were 36.67% of the patients; at the age of 70 years and over 25%. Average maximum systolic velocity (V max) was 0.41 m/s, while the minimum velocity (V min) 4.28 m/s. The value of resistive index (R1) before the procedure was 0.71, while the average diameter of the vein (d) of 8.13 (Table 1). Average maximum systolic velocity (V max) was 0.46 m/s, while the minimum velocity, end diastolic (V min) 4.35 m/s. The value of resistive index (R1) before the procedure was 0.71, while the average diameter of the vein (d) of 8.13 (Table 2).

TABLE 1. Average values of ultrasound examinations before the surgery of a hip replacement.

Results	Average	Min	Max	The standard deviation
Vmax [m/s]	0.41	0.12	1.01	0.25
Vmin [cm/s]	4.28	2.90	6.34	1.04
R1	0.71	0.37	0.92	0.13
Diameter (d)	8.13	2.00	9.60	1.06

TABLE 2. The list of minimum velocity, maximum, average results of ultrasound examinations after the hip replacement surgery and the standard deviation.

Results	Average	Min	Max	The standard deviation
Vmax [m/s]	0.46	0.14	1.12	0.24
Vmin [cm/s]	4.35	2.17	6.45	1.11
R1	0.71	0.37	0.92	0.13
Diameter (d)	8.13	2	9.60	1.06

As a result of statistical analysis it was found that after the procedure maximum systolic velocity improved significantly from 0.41 to 0.46 m/s, ($t=-2.87$, $p=0.006$). Also, the minimum velocity significantly statistically improved, (4.28 m/s to 4.35 m/s), ($t=-2.24$, $p=0.03$) (Figure 1). Research shows that the maximum and minimum velocities are not significantly different before and after surgery in the age group to 59 ($p>0.05$). In the age group of 60-69 years old

TABLE 3. Average values of blood flow, the standard deviation measured before and after hip replacement surgery in successive age groups.

Results	Before surgery		After surgery		Statistical analysis	
	Average	The standard deviation	Average	The standard deviation	t	p
<59 years						
Vmax [m/s]	0.40	0.27	0.41	0.25	-0.25	0.81
Vmin [cm/s]	4.24	1.13	4.23	1.23	0.18	0.86
60-69 years						
Vmax [m/s]	0.37	0.21	0.47	0.20	-7.08	0.000001*
Vmin [cm/s]	4.36	0.95	4.43	1.06	-1.42	0.17
≥70 years						
Vmax [m/s]	0.47	0.27	0.52	0.28	-2.53	0.02*
Vmin [cm/s]	4.23	1.08	4.39	1.05	-6.61	0.00001*

TABLE 4. The average results of the limb circumference before and after hip replacement surgery.

Results	Before surgery		After surgery		Statistical analysis	
	Average	The standard deviation	Average	The standard deviation	t	p
Circumference of the limb at the calf [cm]	38.41	4.30	40.13	4.88	-2.34	0.02*
Circumference of the limb at the ankle [cm]	25.31	4.13	27.80	3.98	-4.14	0.0001*

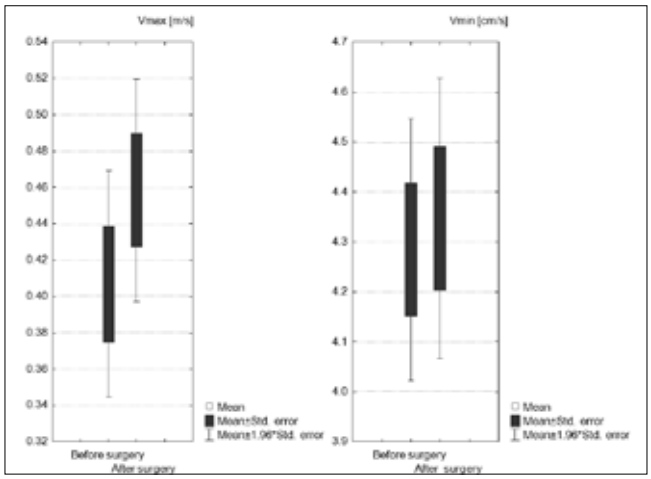

FIGURE 1. Mean values of the maximum and minimum velocity before and after hip replacement surgery.

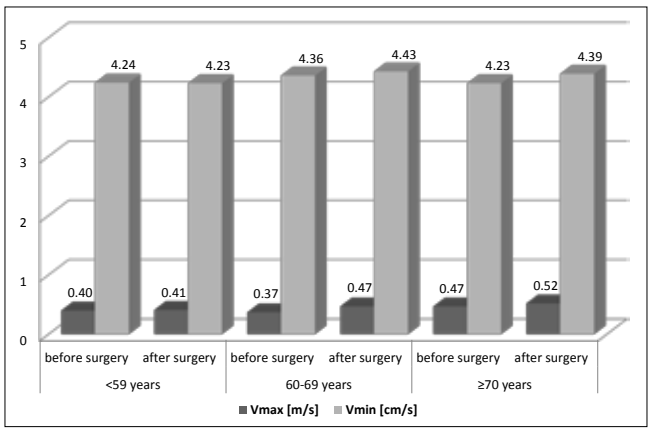

FIGURE 2. The average results of V max and V min before and after surgery in women and in the age groups.

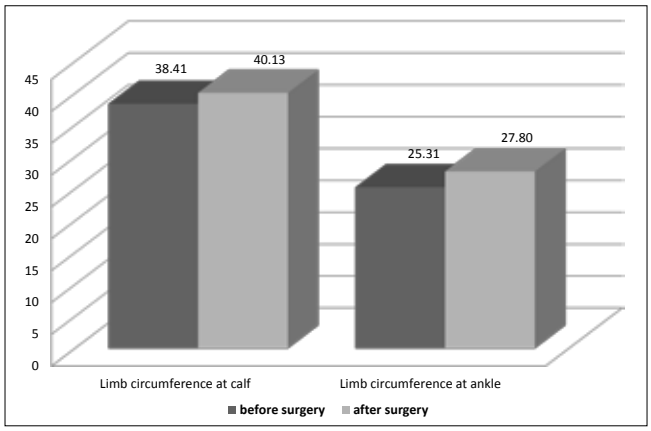

FIGURE 3. Average values of limb circumference before and after surgery.

there were significant differences in the maximum velocity (p=0.000001), while there were no significant differences in the assessment of the minimum velocity (p=0.17). In the age group of 70 years old and more statistical analysis showed significant differences both in the evaluation of the maximum velocity (p=0.02) and minimum (p=0.00001) (Table 3, Figure 1,2).

Statistical analysis showed that after the procedure both the circumference at the height of the calf and the ankle increased. Significant differences were found in the assessment of limb circumference at the height of the calf, (p=0.02). The results are presented in Table 4 and Figure 3.

As a result of statistical analysis it was found that also in the age groups the circumference increased after surgery. There were significant differences in the assessment of limb circumference at the ankle in the age group to 59 years old (p=0.003) and age group of 60-69 years old (p=0.04) and close to significance in the evaluation of the limb circum-ference at the height of the calf in the age group of 70 and more, (p=0.05) (Table 5, Figure 4).

TABLE 5. Average values and standard deviation of the lower limbs measured before and after hip replacement surgery in the age groups.

Results	Before surgery		After surgery		Statistical analysis	
	Average	The standard deviation	Average	The standard deviation	t	p
<59 years						
Circumference of the limb at the calf	38.28	4.57	40.81	5.88	-1.87	0.08
Circumference of the limb at the ankle	24.43	3.70	27.49	4.41	-3.38	0.003*
60-69 years						
Circumference of the limb at the calf	39.45	4.14	39.47	4.17	-0.02	0.98
Circumference of the limb at the ankle	26.57	4.76	28.82	4.09	-2.15	0.04*
≥70 years						
Circumference of the limb at the calf	37.07	3.95	40.07	4.28	-2.12	0.05
Circumference of the limb at the ankle	24.82	3.51	26.79	2.83	-1.53	0.15

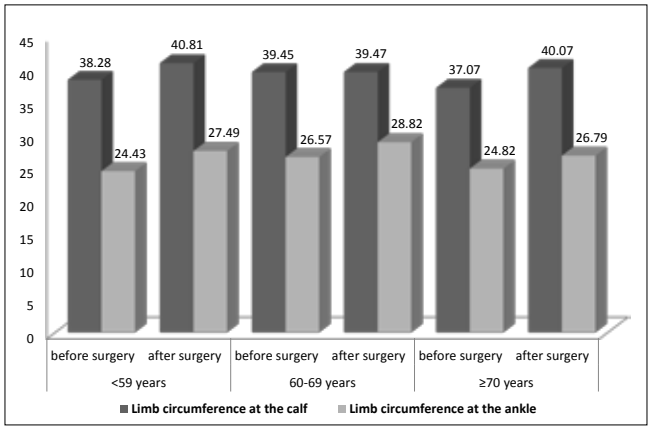

FIGURE 4. Average values of limbs circumference before and after surgery in the age groups.

DISCUSSION

Osteoarthritis of the hip was formerly considered a disease of old age associated with the natural biological process of „aging" of tissues. According to Dieppe et al. degenerative changes are a group of pathological heterogeneous processes that are characterized by localized articular cartilage defects of varying size and depth. They are often accompanied by a substantial overgrowth of subchondral bone. Occurring changes lead to an irreversible deterioration of a joint function [20]. Changes in the hip occur primarily in individuals between a 4th and 7th decade of life. It is more often observed in people between a 2nd and 3rd decade, but the incidence increases proportionally with age of patients – from 4% in the age 18-24 years old, and 85% in the age 75-79. The disease mainly affects women, especially after 50 and people working in conditions of chronic physical strain on the joints [5].

Patients with moderately advanced degenerative changes adequately compensate for physical disability. Later the progress of the disease is the cause of pain which limits motion activities. It reduces the satisfaction of life and daily functioning [21]. Hip replacement surgery eliminates pain and restores a large range of motion of the hip. The greatest danger after the operation, in addition to disturbances in wound healing or early prosthetic dislocations, are threatening thrombotic complications.

According to the literature in 90% of patients, these complications occur about 3rd-4th day after the surgery [22]. Deep vein thrombosis is a major public health problem and its most serious complication – pulmonary embolism – can lead to death. Literature data show that the incidence of thrombosis in patients undergoing orthopedic surgery without thromboprophylaxis is as high as 40% [10,20,23], and despite increasing progress in the prevention, diagnosis and treatment of venous thromboembolism, the incidence of this pathology is increasing. Demographic conditioning of risk factors of venous thromboembolism most likely determines that [24].

The problem of prophylaxis is very important in people of high risk of thrombotic complications, especially in patients who are over 60 years of age, obese, immobile, previously suffering from venous thrombosis. The incidence of pulmonary embolism after surgery, particularly in the large joints is 1 to 0.5% in the case of perioperative prophylaxis [21].

Most prothesoplasty is performed in the 7th-8th decade of life [23-25]. Age-related additional internist burdens, as well as resulting from the essence of the disease process significant limitation of a patient's mobility (which often leads to almost complete immobility, or having to wait many months in the system of queuing for a surgery), perpetuate unhygienic lifestyle. In addition, among the people who are operated on, no properly conducted physical thromboprophylaxis is often observed. Primary health care has no possibility of a proper diagnosis, the use of thromboprophylaxis, monitoring and educating patients and specialized health care and organizational structures do not protect the health needs of all patients [22].

The day after hip replacement surgery it is advisable to introduce the wider prevention exerted primarily on the cardiovascular system [26,27]. The implementation of this mode of action can usually help prevent complications and allow for further improvements. Preventive measures include the correct limb alignment and elastic bandaging of lower limbs. The day after surgery the Burger exercises should be provided and isometric exercises of lower limbs' muscles. An important part of therapeutic rehabilitation is an early erect and intensive walking teaching [28].

The use of effective thromboprophylaxis is also dependent on knowledge of clinical risk factors in a given patient [29]. In our work, much attention was paid on admission from a patient during a physical examinations or vascular tests and circumference measurements of lower limbs.

Analyzing the studies the authors clearly showed that after surgery of a hip replacement a circulating blood flow velocity was significantly improved (from 0.41 m/s to 0.46 m/s, (t=-2.87, p=0.006). It seems very likely that such a large impact on the results was performed thanks to exemplary rehabilitation. Patients included in the research were under the strict supervision of a physiotherapist from the planning to the implantation of artificial hip joint.

The results of our study also showed that in different age groups (up to 59, 60-69, over 70 years old), the circumference increased following the results of a surgery. There were significant differences in the assessment of limb circumference at the ankle in the age group to 59 years (p=0.003) and age group of 60-69 (p=0.04) and close to significance in the assessment of limb circumference at the height of the calf in the age group of 70 or more (p=0.05). About 70% of patients have a swelling of the operated leg compared to not operated, regardless of the number of risk factors, which is not synonymous with the occurrence of venous thromboembolism.

It was noted that in the studied parameters (V max systolic and V min end diastolic) blood flow circulating in the leg after the knee replacement surgery significantly increased after the regularly used anticoagulant therapy. In our study the highlights of importance were focused on the application, in addition to chemoprophylaxis, of physiotherapeutic treatment that improves blood flow in the lower limbs. The introduction of anticoagulant, isometric, active exercises of appropriate muscle groups and breathing exercises especially in people over age 65 at the first day after the procedure, will significantly reduce the incidence of deep vein thrombosis.

CONCLUSIONS

The studies demonstrated the justification and desirability of planned active antithrombotic exercises in all patients after total hip replacement since the first day after the surgery.

REFERENCES

1. Raczyński J, Koraczak D, Orzechowski J. Thromboembolic complications after total hip arthroplasty. Diary of XXVII Congress of the Polish Society of Orthopaedics and Traumatology. Warszawa 13-15. X. 1998. p. 49-56.
2. Garlicki M, Kreczko R. Arthrosis deformans Coxa. Warszawa: PZWL; 1974.
3. Keuttner K, Goldberg VM. Osteoarthritis Disorders. Rosemont PA: American Academy of Orthopedic Surgeons;1995.
4. Cooper C, Walker-Bone H, Dennison EM, et al. Osteoarthritis: epidemiology, risk factors, burden of disease and prevalence. Osteoporosis Int. 2002;13(Suppl. 1):141.
5. Srokowski G. The study of the load of lower limbs in patients after hip replacement surgery in the assessment of joint congruity and conducted rehabilitation. Orthopedics Quarterly. 2005;3:227-36.
6. Callaghan JJ, Warth LC, Hoballah JJ, Evaluation of deep venous thrombosis prophylaxis in low-risk patients undergoing total knee arthroplasty. J. Arthroplasty 2008;23(6 Suppl. 1):20-24.
7. Kubiś W. Rules of conduct of early rehabilitation in patients after total hip replacement. Diary of XXVII Congress of the Polish Society of Orthopaedics and Traumatology. Warszawa 13-15. X. 1998. p. 71-6.
8. Comerota AJ, Paolini D. Treatment of acute iliofemoral deep vein thrombosis a strategy of thrombus removal. Eur J Vasc Surg. 2007;33(3):351-60.
9. Rubinstein I, Murray D, HofsteinV. Fatal pulmonary embolism in hospitalized patients. Arch Intern Med. 1988;148;1425-526.
10. Borghi B, Casati A. Thromboembolic complications after total hip replacement. Int Orthop. 2002;26(1):44-7.
11. Hull RD, Raskob GE, Hirsh J. Prophylaxis of venous thromboembolism: an overview. Chest. 1986;89:374-83.
12. Barrelier MT, Rouen E, Creveuil C. Discrepancies between the results of phlebography and Doppler ultrasonography in the diagnosis of asymptotic venous thrombosis after total hip prosthesis. False negatives of flebography or false positives of Doppler ultrasonography. J Mal Vasc. 1998;23(3):183-90.
13. Tomkowski WZ. Zator tętnicy płucnej i zakrzepica żył głębokich. Gdańsk: Via Medica; 2004.
14. Villemur B, Bosson JL, Diamand JM. Deep venous thrombosis (DVT) after hip or knee prosthesis. Evaluation of practices and prevalence of DVT on Doppler ultrasonography. J Mal Vasc. 1998;23(4):257-62.
15. Barden B, Kroger K, Loer F. Unfallchirurg. 2001 Feb;104(2):138-42.
16. Schiff RL, Kahn SR, Shrier I. Identifyng orthopedic patients at high risk thromboembolism for venous despite thromboprophylaxis. Chest. 2005;128(5):3364-71.
17. Spritzer CE, Arata MA, Freed KS. Isolated pelvic deep venous thrombosis; relative frequency as detected with MR imaging. Radiology. 2001;219:521-5.
18. Zhan C, Kaczmarek R, Loyo-Berrios N, et al. Incidence and short-term outcomes of primary and revision hip replacement in the United States. J Bone Joint Surg Am. 2007;89(3):526-33.
19. Zembaty A. Kinesitherapy. Kraków: Wydawnictwo Kasper Sp. z o.o.; 2002.
20. Senger A, Degenerative – deforming arthritis. Orthopedics and Rehabilitation. Warszawa: PZWL;1984. p. 688-94.
21. Gągała J, Mazurkiewicz T. First experiences with total hip resurfacing arthroplasty. Chir Narz Ruchu Ortop Pol. 2007;72,5:311-7.
22. Jabłoński M, Turżańska K, Gorzelak M, et al. Asymptomatic venous thromboembolism before the surgery of a hip arthroplasty – when is the risk significant? Chirurgia Narządu Ruchu i Ortopedia Polska. 2008;73(6):381-5.
23. Mont MA, Jones LC, Rajadhyaksha AD, et al. Risk factors for pulmonary emboli after total hip or knee arthroplasty. Clin Orthop Relat Res. 2004;422:154-63.
24. Marcy GH, Fletscher RS. Modification of the posterolateral approach to the hip for insertion of femoral-head prosthesis. J Bone Joint Surg. 1954;36(1):142-3.
25. Ciccone WJ, Fox PS, Neumyer M. Ultrasound surveliance for asymptomatic deep venous trombosis after total joint replacement. J Bone Joint Surg Am. 1998;80(8):1095-6.
26. Heit JA, Melton LJ, Lohse CM. Incidence of venous thromboembolism in hospitalized patients vs community residents. Mayo Clin Proc. 2001;76(11):1102-10.
27. Magnusson M, Ericsson BI, Kalebo P. Is colour Doppler ultrasoud a sensitive screening method in diagnosis deep vein thrombosis after hip surgery? Tromb Haemost. 1996;75(2):242-5.
28. Pozowski A. Thromboembolic complications after arthroplasty of large joints of the lower limb. Orthopedic Quarterly. 2000;2:97-101.
29. Sobol AB. Thromboembolic complications in patients of primary care. Public Health. 2002;112(3):369-400.

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