DISCUSSION PAPERS, LECTURES, NEW TRENDS IN MEDICAL SCIENCE

ASSESSING SOCIO-ECONOMIC DAMAGE CAUSED BY COXARTHROSIS IN THE POPULATION

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ABSTRACT

Background. *About 40 % of patients diagnosed with coxarthrosis annually seek medical help and receive social support due to this disease. Increased use of an expensive surgery for treatment of coxarthrosis and projected growth of its prevalence in the population determine the relevance of socio-economic analysis.*
The aim of the study. *To assess the value and structure of economic damage caused by the delivering health and social care to patients with coxarthrosis at the state level of the Russian Federation.*
Methods. *To assess economic damage, we used the average annual number of various categories of patients and disabled people with coxarthrosis in the Irkutsk region for 2008–2017. Three main categories were identified: patients who visited the outpatients' clinic; patients with total hip replacement; disabled people due to coxarthrosis. For each category, we calculated weighted average damage per 1 conventional patient, taking into account direct and indirect costs and subsequent multiplication by the average annual number of individual categories of patients. Calculations were performed in 2017 prices.*
Results. *The average annual socio-economic damage from coxarthrosis amounted to 1.39 (1.34÷1.43) billion rubles or 0.1 % of the gross regional product. The most of the damage (64.4 %) were indirect costs associated with disability due to coxarthrosis, 22.2 % of the total amount were the costs of hip replacement surgery, 13.4 % were the costs of outpatient visits. Indirect economic losses due to disability in patients of working age were 4.2 times higher than losses due to disability of old-age pensioners.*
Conclusion. *The results of the study confirm the economic feasibility of surgical treatment of coxarthrosis, especially in patients of working age.*

Key words: *coxarthrosis, outpatient and inpatient treatment, endoprosthesis replacement, disability, socio-economic damage*

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ОПЫТ ОЦЕНКИ СОЦИАЛЬНО-ЭКОНОМИЧЕСКОГО УЩЕРБА, ОБУСЛОВЛЕННОГО ЗАБОЛЕВАЕМОСТЬЮ НАСЕЛЕНИЯ КОКСАРТРОЗОМ

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РЕЗЮМЕ

Обоснование. *Около 40 % пациентов с установленным диагнозом «коксартроз» ежегодно обращаются за медицинской помощью и получают социальную поддержку в связи с этим заболеванием. Всё более широкое применение дорогостоящей операции для лечения и прогнозируемый рост распространённости этой патологии в популяции определяют актуальность проведения социально-экономического анализа.*

Цель исследования. *Оценка величины и структуры экономического ущерба в связи с оказанием медицинской и социальной помощи пациентам с коксартрозом на уровне субъекта Российской Федерации.*

Методы. *Для оценки экономического ущерба использовали среднегодовую численность различных категорий пациентов и инвалидов с коксартрозом в Иркутской области за 2008–2017 гг. Выделены три основных категории: пациенты, посетившие поликлинику; пациенты с тотальным эндопротезированием тазобедренного сустава; инвалиды по коксартрозу. Для каждой из категорий рассчитан средневзвешенный ущерб на 1 условного пациента с учётом прямых и непрямых затрат и последующим умножением на среднегодовую численность отдельных категорий пациентов. Расчёты выполнены в ценах 2017 г.*

Результаты. *Среднегодовой социально-экономический ущерб от коксартроза составил 1,39 (1,34÷1,43) млрд руб. или 0,1 % от валового регионального продукта. Основную часть ущерба (64,4 %) составляли непрямые затраты в связи с инвалидностью по коксартрозу, 22,2 % от общей суммы – затраты на эндопротезирование тазобедренного сустава, 13,4 % – затраты на поликлинический приём пациентов. Непрямые экономические потери из-за инвалидности в трудоспособном возрасте в 4,2 раза превышали потери из-за инвалидности пенсионеров по старости.*

Заключение. *Результаты исследования подтверждают экономическую целесообразность хирургического лечения коксартроза, особенно у пациентов трудоспособного возраста.*

Ключевые слова: *коксартроз, амбулаторное и стационарное лечение, эндопротезирование, инвалидность, социально-экономический ущерб*

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INTRODUCTION

Assessment of socio-economic efficiency of high-tech medical care is an urgent scientific task. Coxarthrosis is among the chronic diseases with a low mortality rate, a high probability of disability and a significant reduction in quality of life. Hip replacement surgery is an expensive procedure, so many countries undertake a cost assessment of this treatment method. The results of studies confirm not only the clinical but also the cost-effectiveness of the treatment [1, 2]. Economic damage from coxarthrosis is increasing as a result of the increasing prevalence of the disease with the growing number of older age groups and obese people in the population of many countries around the world [3]. Recently, there has been a trend towards the development of the disease in younger individuals as a result of traumatic joint damage due to the increasing popularity of injury-prone sports [4]. Environmental problems of the modern world are also among the risk factors for this pathology [5–7]. Obviously, the medical community should be prepared for a significant increase in the demand for medical services for hip osteoarthritis treatment.

The majority of studies involving cost estimation caused by coxarthrosis have been published by foreign researchers. The dependence of treatment costs on the age of patients, the cost of prostheses, and a variety of other factors has been noted [8–10]. An experience of extrapolating the results of sample studies to the whole population of the country is also available [11].

Similar studies in the Russian Federation are very limited and focus not only on coxarthrosis, but on osteoarthritis in general [12–14]. Methods for assessing disease damage and cost-effectiveness of treatment can vary significantly depending on the specifics of the pathology under study, as well as among different authors, which makes it difficult to use the results in practical healthcare [15, 16]. This defines the relevance of continuing research to assess the socio-economic significance of osteoarthritis, taking into account the peculiarities of the organization of domestic health care.

Previously, we evaluated the average annual number of patients who received various types of medical care and social benefits in connection with the treatment of coxarthrosis by using the materials of the Irkutsk Region [17]. As a result, it was therefore possible to use the data obtained to calculate the damage from this disease to the economy of the region.

THE AIM OF THE STUDY

To assess the value and structure of economic costs of delivering health and social care to patients with coxarthrosis at the regional level.

MATERIALS AND METHODS

A retrospective epidemiological study was undertaken based on the materials of the Irkutsk region, including the data of the specialized trauma clinic of the Irkutsk Scientific Centre of Surgery and Traumatology. To assess the economic damage, the average annual number of different categories of patients and disabled people with coxarthrosis in the Irkutsk region for the period 2008–2017, determined in an earlier study [17], was used. Three main categories were identified: patients who visited the outpatient clinic; patients with total hip replacement (THR) surgery; and those disabled by coxarthrosis. The ratio of different categories of patients was further clarified using continuous samples from one of the polyclinics of the regional center ($n = 1237$) and the specialized clinic of the Irkutsk Scientific Center of Surgery and Traumatology for 2017 ($n = 782$). Calculations were performed in 2017 prices.

Direct and indirect socio-economic damage was assessed using methods previously tested in domestic healthcare [4, 12, 16, 18–20]. The weighted average damage per conditional case of coxarthrosis in different categories of patients was measured during the first stage. The obtained values were used to calculate the total regional costs through multiplying them by the average annual number of individual categories of patients with coxarthrosis. Confidence intervals with a significance level of 95 % (95% CI) for the amounts obtained were calculated by proportion based on previously determined 95% CIs for the number of patients in different categories [17].

Direct costs for outpatients included the cost of visits to various specialists at the primary care without taking into account the cost of medicines purchased at the patients' expense. The attendance cost was calculated based on the funding included in the territorial programme of compulsory health insurance, considering the coefficient of differentiation and increase in the cost of medical services across the Irkutsk region in accordance with the Appendix to the Federal Law dated December 19, 2016 No. 418-FZ "On the budget of the Federal Compulsory Health Insurance Fund for 2017 and for the planning period of 2018 and 2019" [21]. The weighted average attendance cost of different specialists was calculated using a continuous sample of outpatients who applied for coxarthrosis for the first time or repeatedly during the year ($n = 1237$) in one of Irkutsk primary care in 2017. Direct expenses in connection with THR are accepted according to the calculations of the accounting department of the specialized clinic of the Irkutsk Scientific Center of Surgery and Traumatology, made in accordance with the Resolution of the Government of the Russian Federation dated December 19, 2016 No. 1403 "On the program of state guarantees of free medical care for citizens for 2017 and for the planning period of 2018 and 2019". According to these data, the average cost of surgical treatment and hospitalization of a patient with one-stage and two-stage, unilateral and bilateral surgery and revision intervention amounted to 185,930 rubles.

The indirect costs of temporary disability (TD) benefit, lost gross regional product (GRP) and income tax due to sickness absence were differentiated according to the duration of TD and the proportion of working patients who received sick leave. These parameters were determined for outpatients using the continuous sample mentioned above (n = 1237). The proportion of employed among patients with THR surgery and the duration of hospital treatment for different types of surgery were also determined from a continuous sample of case histories (n = 782). The duration of TD during the rehabilitation period after hospital discharge was included in the calculations. Indirect damages for coxarthrosis disability and permanent disability (PD) included monthly pension payments, as well as GRP and income tax losses due to termination of employment prior to old-age retirement.

Information about the population employed in the economy, GRP per capita (2005.5 RUB per day), TD benefit (1813.6 RUB per day), PD benefit (15643.3, 17861.6 and 20893.8 RUB per month, depending on the disability group) and average personal income tax (PIT) (231.8 RUB) were obtained from the website of the Territorial Body of the Federal State Statistics Service for the Irkutsk Oblast over the course of the year 2017 [22].

RESULTS

Estimation of costs associated with outpatient clinic visits and outpatient treatment

The structure of direct costs for outpatients with coxarthrosis is presented in Table 1. The attendance costs of different specialists did not differ significantly, and the weighted average costs did not differ much from the arithmetic mean of the attendance costs (188 RUB). Consequently, at this stage there is an opportunity to simplify the calculation algorithm. A random sample of patients who visited the outpatient clinic for coxarthrosis was found to be 1.5 % of patients who received a sick leave for outpatient treatment, with a mean duration of TD lasting 30 days. Considering the duration of TD, the indirect loss per 1 patient with outpatient conservative treatment, including TD benefits and losses of GRP and taxes, amounted to 121,527 RUB (1813.6 + 2005.5 + 231.8 = 4050.1 RUB × 30 days). The obtained value of weighted average costs was used in the final calculation of losses caused by coxarthrosis (Table 5).

Estimation of costs associated with the total hip replacement surgery

The weighted average direct costs per 1 operated patient (185,930 RUB), as noted above, are calculated in the medical organization that performed prosthetics. This also made it much easier to estimate total costs. Indirect costs depended on the duration of treatment for different types of medical care and the proportion of working patients, which was 27.2 % (n = 213) of the total number of operated patients (Table 2). The obtained value of weighted average costs was used in the final calculation of losses from coxarthrosis (Table 5).

Assessment of damages due to coxarthrosis disability

Direct costs related to the provision of medical care to persons with disabilities are accounted for together with other categories of patients. The indirect damage was partially dependent on the proportion of group III disabled persons who continued to be employed but, due to THR, received TD benefits and did not participate in the creation of GRP during this period. These economic losses are accounted for in Table 2 and, accordingly, an adjustment is made in the final Ta-

TABLE 1

CALCULATION OF WEIGHTED AVERAGE DIRECT COSTS FOR OUTPATIENT ATTENDANCE OF PATIENTS WITH COXARTHROSIS ACCORDING TO THE POLYCLINIC DATA OVER THE YEAR 2017

Specialist attendance	Number of visits (n = 1,237)	The cost of 1 attendance, RUB	Amount of costs, RUB*
Therapist (initial attendance)	366	195.8	71663
Therapist (follow-up visit)	450	150.9	67905
Surgeon (initial attendance)	16	194.7	3115
Surgeon (follow-up visit)	3	165.2	496
Rheumatologist (initial attendance)	243	249.0	60507
Rheumatologist (follow-up visit)	159	172.7	27459
Total cost amount			231145
Weighted average cost of 1 patient visit			**187**

Note. * – rounded to integers.

ble 5 for the amount of indirect economic loss in the "able-bodied disabled" category. The correction was calculated on the basis of sample data, according to which the proportion of working disabled persons of group III accounted for 13.6 % of the number of patients who underwent surgery. After extrapolating these data to the average annual population of THR patients, it turned out that among them 84 disabled people were employed. The amount of indirect damage for this small group of disabled persons, taking into account the timing of TD as a result of THR surgery, amounted to 46,432,428 RUB per year (552,767 RUB × 84).

A more significant part of the damage is associated with payments of disability pensions depending on the disability group (Table 3).

Most of the damage was determined by the loss of GRP due to the onset of PD at working age. The number of working years and days lost by disabled individuals was determined using the retirement age for men and women in 2017 and the number of working days per year (247). As previously found, the proportion of coxarthrosis disabled persons who became disabled one year or more before old-age retirement was 54 % of their total number (n = 1,033). Damage amounts were calculated separately for men and women (Table 4).

As a result, the weighted average indirect damage associated with the payment of pensions to disabled persons, loss of GRP and taxes caused by the PD amounted to 747,702 RUB per year per 1 disabled person of work-

TABLE 2

CALCULATION OF THE WEIGHTED AVERAGE INDIRECT LOSS DUE TO THR SURGERY FOR EMPLOYED PATIENTS WITH COXARTHROSIS BASED ON 2017 DATA FROM A SPECIALIZED MEDICAL CLINIC

Type of medical care	Number of patients (n = 213)	Duration of 1 patient's treatment, days	Total number of days of TD	Amounts of damage, RUB			
				TD benefits	GRP losses	personal income tax losses	total*
Unilateral one-stage surgery	197	16	3152	5,716,467	6,321,336.0	730,633.6	12,768,437
Bilateral one-stage surgery	5	22	110	199,496	220,605.0	25,498.0	445,599
Unilateral two-stage surgery	2	27	54	97,934	108,297.0	12,517.2	218,749
Revision surgery	9	21	189	342,770	379,039.5	43,810.2	765,620
Outpatient postoperative follow-up treatment	213	120	25,560	46,355,616	51,260,580.0	5,924,808.0	103,541,004
Total cost amount							117,739,409
Weighted average costs per 1 employed patient							**552,767**

Note. * – rounded to integer values.

TABLE 3

CALCULATION OF WEIGHTED AVERAGE INDIRECT DAMAGES FOR COXARTHROSIS DISABILITY PENSION PAYMENTS (NUMBER OF DISABLED PEOPLE BASED ON AVERAGE DATA FOR 2008–2017)

Disability groups	Number of persons with disabilities (n = 1,908)	Amounts of damage, RUB		
		pension amount per month	annual pension amount	benefit amount per year*
Group I	36	20,893.8	250,725.6	9,026,122
Group II	443	17,861.6	214,339.2	94,952,266
Group III	1429	15,643.3	187,719.6	268,251,308
Total				372,229,696
Weighted average damage per 1 disabled person (RUB)				195,089

Note. * – rounded to integer values.

ing age (195,089 + 552,613 RUB). For disabled persons of old-age pension age, the weighted average loss is conditioned only by the payment of pensions and corresponded to the value shown in Table 3.

Assessment of damage to the regional economy

At the final stage, the weighted average costs for different categories of patients with confirmed coxarthrosis were used to calculate the total costs for the year for in-

TABLE 4

CALCULATION OF THE ANNUAL INDIRECT DAMAGE DUE TO THE LOSS OF GROSS REGIONAL PRODUCT AND PERSONAL INCOME TAX AS A RESULT OF A PERMANENT LOSS OF WORKING CAPACITY DUE TO COXARTHROSIS BEFORE RETIREMENT DUE TO OLD AGE (THE NUMBER OF DISABLED PEOPLE BASED ON AVERAGE DATA FOR 2008–2017)

Groups	Number of persons with disabilities a year or more before old-age pension age (*n* = 1,033)	The number of lost working days per year	The amount of lost working days	GRP damage + tax for 1 day, RUB	Amounts of damage, RUB*
Women	596	247	147,212	2237.3	329,357,408
Men	437	247	107,939	2237.3	241,491,925
Total					570,849,333
Weighted average damage per 1 disabled person of working age					552,613

Note. * – rounded to integer values.

TABLE 5

RETROSPECTIVE ASSESSMENT OF THE AVERAGE ANNUAL SOCIO-ECONOMIC DAMAGE ASSOCIATED WITH THE PROVISION OF MEDICAL AND SOCIAL CARE TO PATIENTS WITH COXARTHROSIS IN THE IRKUTSK REGION (IN 2017 PRICES)

Patient groups		Average annual number of patients*	Amount of damage (RUB)				Share in the amount of damage (%)
			direct costs per 1 patient	indirect costs per 1 patient	sum of direct and indirect costs per 1 patient	amount of damage in terms of number of patients (95% CI)*	
Patients of outpatient clinics	employed	1,497	187	121,527	121,714	182,205,858	**13.4**
	unemployed	28,209	187	0	187	5,275,083	
	total	29,706* (29,379÷30,018)			**187,480,941** (185,417,174÷189,450,040)		
Patients with THR surgery	employed	350	185,930	552,767	738,697	258,543,950	**22.2**
	unemployed	271	185,930	0	185,930	50,387,030	
	total	621* (564÷671)			**308,930,980** (280,574,996÷333,804,650)		
Disabled people	able to work	1033	**	747,702	747,702	725,943,738***	**64.4**
	unable to work	875	**	195,089	195,089	170,702,875	
	total	1,908* (1,876÷1,932)			**896,646,613** (881,608,515÷907,925,187)		
Total					**1,393,058,534** (1,347,600,685÷1,431,176,877)		**100**

Note. * – average annual number of patients with coxarthrosis during 2008–2017 according to [17]; ** – counted together with other patients of polyclinics and hospital; *** – adjusted (reduced by 46,432,428 RUB, explanations in the text).

dividual areas and for the region as a whole (Table 5). The main component of the total amount represents damages caused by PD. A comparison of total direct and indirect costs for the three main cohorts of patients with coxarthrosis shows that more than 60 % of the damage is associated with disability. Total economic losses associated with prosthetics were 1.7 times greater compared to outpatients, whose numbers were nearly 30 times greater.

The damage associated with the provision of medical care to working patients is significantly higher than that for patients who are not employed at work. This is determined by the higher number of employed patients among those seeking medical care and the indirect costs as a result of TD. The non-medical disability damage amounts were higher in the group of patients disabled before old-age retirement and were largely determined by the PD. Indirect economic losses due to disability in patients of working age were 4.2 times higher than losses due to disability of old-age pensioners.

The amount of direct costs for patients who underwent THR surgery for the year amounted to 115,462,530 RUB, which is about 20 times more than the direct costs for primary care patients (5,555,022 RUB). In total, all direct costs of medical organizations for the admission and treatment of patients accounted for only 8.7 % of the total coxarthrosis damage for the region during the year.

DISCUSSION

The study found that in a region with a population of about 2.5 million people, the economic damage from coxarthrosis exceeded 1.3 billion RUB per year (in 2017 prices), which amounted to about 0.1 % of GRP. Meanwhile, the prevalence of coxarthrosis in the population was previously estimated by us at 77.8 thousand people or 4.1 % of the total population [17]. Only 40.1 % (31,200) of them applied for medical care and received social benefits during the year.

Characterizing the cost structure appears to be a more important output of the work than determining the total amount of damage. Most of the damage is associated with early onset permanent disability and loss of working ability. As a result of the increase in the retirement age during the pension reform in 2019, the economic significance of this component of the damage increases significantly. Indirect costs prevailed in the damage structure as a whole (more than 64.4 %). It should be highlighted that the direct costs of implementing THR to medical organizations were about half as much as the social payments to the employed patients who underwent surgery. In 2008–2017, the vast majority of prosthetics were performed at the expense of the Compulsory Medical Insurance Fund, and only in a few cases the costs were paid by patients.

Thus, the cost structure confirms the economic feasibility of surgical treatment of coxarthrosis. We could not find any domestic publications devoted to the assessment of the socio-economic significance of coxarthrosis in the literature available to us. But the results we obtained are in general agreement with the data related to osteoarthritis of different localisation. For instance, it was found that indirect costs associated with the treatment of osteoarthritis prevailed and amounted to 70.4 % for an employed patient as a consequence of unproduced output at the onset of TD, and 91.4 % of the total amount of losses caused by the disease for a non-working disabled patient. In this case, the losses of personal income tax have not been considered [14]. A number of foreign studies have revealed that hip arthroplasty is much more favorable than conservative treatment, even for patients over 80 years of age [8, 23].

A simplified system of calculations was used, as the weighted average values of direct costs of inpatient and outpatient clinics were pre-calculated by the economists of medical organisations based on federal regulatory and methodological documents. Consequently, we have differentiated the costs of different surgery scenarios only in terms of indirect costs. The main complications are related to estimating the prevalence of coxarthrosis in the population and determining the number of population categories with a relatively homogeneous cost structure, which has been discussed by us previously [17], as well as by other studies [8, 16]. Precisely at this stage of the study, errors that can significantly distort estimates of economic damage are possible.

Other possible uncertainties and limitations of the study should be considered. Obviously, the estimate we obtained is underestimated, as it does not include costs from patients' and their families' funds, such as the purchase of medicines and orthopaedic equipment, transport costs and others. It has previously been shown that the economic burden is imposed not only onto the health care system, but also to the patient, whose ability to self-care is dramatically reduced, as well as to his or her family, which has to allocate financial, moral and physical resources to care for the disabled person [14, 24, 25]. According to some authors, the risks of complications associated with comorbid pathology, common among patients with reduced physical activity, should be included in the costs [11]. However, these costs are highly individualized as well as being difficult to account for.

This study is retrospective in nature, so absolute values of monetary estimates cannot be currently used as a consequence of changes in pricing policy, inflation and variability in the rate of people seeking medical care in the course of follow-up control. However, estimating the cost ratio of individual areas can be useful in making management decisions. The algorithm for estimating costs and damage to the economy that has been tested out is available for reproduction and is recommended for justification of further development of high-tech medical care for patients with coxarthrosis at the regional level.

CONCLUSIONS

In summary, the study revealed that the average annual socio-economic damage from coxarthrosis, associated with patients seeking medical care, payment of social benefits and losses of the region's economy due to perma-

nent disability, amounted to 1.39 (1.34÷1.43) billion RUB or 0.1 % of the gross regional product (in 2017 prices). The most of the damages (64.4 %) were indirect costs associated with disability caused by coxarthrosis, 22.2 % of the total amount was determined by the costs of hip replacement and 13.4 % by the costs of outpatient clinic services. The results of the study confirm the economic feasibility of coxarthrosis surgical treatment, especially in patients of working age.

Conflict of interest

The authors of this article declare no conflicts of interest.

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