



Surgical terminological units: structure, meaning, distribution

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Abstract: The article focuses on a crucial human-related issue of nominating surgical interventions. The authors dwell upon the terms of cardiovascular manipulations and lower limb amputation. Medical terminology is of primary significance to both professionals and non-medical subjects due to its vital nature. Given the prevalence of current anthropocentric research works, this study is relevant. The relevance is further supported by a set of approaches to the surgical terminology followed in the study, in particular, semantic, structural, contextual analysis as well as the tools of online and offline text processing. The complexity and sophistication of the surgical discourse requires detailed and multifaceted analysis for their meaning and contextual use clarification. The article aims at revealing the semantic and structural specifics of the surgical terms based on medical written and spoken texts. The research rested on approximately 200 terminological units retrieved from the texts of a surgical Handbook and surgical manipulation video scripts. The work was performed in four stages. The analysis revealed that structurally, nominal word combinations prevail over verbal ones. The most frequent verbal meanings are 'to open', 'to close', 'to introduce', 'to remove', 'to connect' and 'to find'. The semantic classification of the terms revealed that the stages of surgery, anatomical structures and instruments are nominated more frequently. The concordance lines generated by the AntConc tool for the key terms provided vivid representation of their contextual functions, features and collocations with body parts, body systems, and implementation methods.

Key words: medical terminology; surgery; semantics; verbs; context; concordance lines; corpus.

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Терминологические единицы хирургии: структура, значение, дистрибуция

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Аннотация: Статья посвящена одному из важнейших вопросов деятельности человека – номинациям хирургических вмешательств. Авторы подробно рассматривают термины проведения сердечнососудистых манипуляций и ампутации нижних конечностей. Медицинская терминология имеет важное значение как для профессионалов, так и для людей немедицинских специальностей. Актуальность данной работы обусловлена господствующей антропоцентрической парадигмой исследований в современной науке. Исследование актуально также в силу ряда используемых подходов к изучению хирургической терминологии, в частности семантического, структурного, контекстуального анализа, а также благодаря использованию онлайн- и офлайн-инструментов анализа текста. Сложность хирургического дискурса требует детального и разностороннего анализа семантики и контекстуального употребления терминологических единиц. Статья нацелена на выявление структурной и семантической специфики хирургических терминов на основе медицинских письменных и устных текстов. Исследование реализовано на материале 200 терминологических единиц, извлеченных из текстов хирургического справочника и текста видео, описывающих хирургическое вмешательство. Работа включала четыре этапа.

Анализ структурных типов показал превалирование именных словосочетаний над глагольными. Наиболее частотными глагольными значениями являются «открывать», «закрывать», «вводить», «удалять», «соединять» и «находить». По результатам семантической классификации терминов выявлено преобладание номинаций этапов хирургических вмешательств, анатомических структур и инструментов. Линии соответствия, сгенерированные инструментом AntConc для ключевых терминов, наглядно продемонстрировали их контекстуальные функции, особенности и выявили сочетания с частями тела, системами организма и методами реализации.

Ключевые слова: медицинская терминология; хирургия; семантика; глаголы; контекст; линии соответствия; корпус.

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Информация о конфликте интересов: авторы заявляют об отсутствии конфликта интересов.

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Introduction

Recently, the specifics of medical terminology have been providing extensive research material for numerous works [Ferguson 2001; Traynor 2006; Wilce 2009]. In this study we focus on surgical terminological units (hereinafter STUs) and their specifics in the surgical texts. We follow the approach distinguishing codified and uncoded terms [Andreeva 2013; Andreeva 2016; Andreeva 2017; Solnyshkina 2023]. The formed are the terms registered in the dictionaries, whereas the latter are not and revealed in the course of oral or written professional communication [Solnyshkina 2023]. Thus, we focus on the codified STUs, i. e. the core of the medical terminological system.

Medical procedures, minor and major, are part and parcel of human life. The problem of appropriate understanding, use and interpretation of medical linguistic units is pivotal and requires multifactorial study as a research niche. This research into the semantic, structural and contextual specifics attempts to unveil the complex nature of the STUs.

The anthropocentric research works are predominant in current scientific and academic works. Given the nature of the human orientation of the medical terminological units, this study is relevant. Furthermore, a number of approaches to the study of surgical terms followed in the research work, namely, semantic, structural, contextual analysis as well as the tools of online and offline text processing contribute to the research novelty.

The research aims at revealing the semantic and structural specifics of the STUs with regard to their use in the medical written and spoken discourse.

The aim predetermines the following research tasks: 1) to elicit STUs from the surgical video texts and guidebooks; 2) to classify one-word STUs and word combinations according to their structural types; 3) to determine the most frequently used verbal semes describing the surgical interventions; 4) to find word combinations with the determined verbs; 5) to classify the STUs into semantic groups and sub-groups; 6) to study the distribution of the key topic words and their word forms in the texts studied applying the AntConc tool.

Current interest of linguists to the medical discourse and terminology is partly predetermined by the

appearance of multiple triggers deteriorating human health. Bekisheva et. al. classify the vast domain of medical terminology into the terms of general science, general medicine, inter- and intradisciplinary terms and jargonisms [Bekisheva, Bunina 2015]. Lukoyanova focuses on the nominations of surgical instruments in German and explains the origins and reasons for coining surgical terms and ways of borrowings [Lukoyanova 2019]. The semantic specifics of the medical terms were experimentally researched by Balobanova among surgeons and other medical experts. The respondents were asked to explain given stimulus words. Many subjects resorted to extensive and detailed definitions. The obtained experimental linguistic data suggests that when describing the medical notions and terms surgeons focus on a variety of features including etiology, symptoms, signs, and course of the disease [Balobanova 2014].

The research comprised 4 stages, accorded with the following research questions (RQ):

RQ1: What is the structural specifics of the STUs?

RQ2: What are the most frequent verbal semes of the STUs?

RQ3: What semantic groups prevail among the STUs?

RQ4: What is the contextual specifics of key terms used in the surgical handbooks?

Materials and methods

The research material comprised 200 STUs elicited from the video texts about coronary bypass (CAB) and below knee amputation (BKA). Apart from that, the contextual specifics of the key terms were revealed based on more than 1000 concordance lines in the texts selected from the Oxford Handbook of Clinical Surgery (hereinafter OHCS). All the examples retrieved from the OHCS were registered in the authors' corpus and marked with a code that implied a letter and a number (e. g. ES1 stands for example sentence 1).

AntConc tool allows the processing of any text uploaded into the tool in txt format (AntConc). The installed software generates and calculates numerous parameters of text processing, such as, the concordance lines, KWIC output, N-grams, collocates and clusters.

The research was implemented based on the following methods: description, elements of statistical

analysis, lexicographic, semantic and distributional analysis.

We follow the structural approach to word semantics. The seme is defined as ‘a minimal component of the meaning’ [Naciscione 2010]. We share the theories of I.A. Sternin, who claimed the word to have core, differential and potential semes [Sternin 2011]. The core of a word meaning is its basic and most generic layer, the periphery aids at differentiating between various words. Whereas the potential semes add extra components to a word and are more likely to be revealed only through the contextual and distributional analysis [Novikov 2021]

The context is viewed as one of the tools to study the features of the STUs [Fan, Friedman 2007; Van der Plas, Tiedemann 2010; Ahltop, Skeppstedt, Kitajima, Henriksson, Rzepka, Araki 2016; Mikhailova 2020; Leontieva 2022; Shchipkova 2023]. The context functions as ‘a semantic implementation of a word, regardless of the lexical meanings of the words included in this construction’ [Amosova 2013]. Context also serves as a good means to unveil possible collocations of the STUs.

To implement Stage I, we resorted to the structural theories introduced by V.D. Arakin [Arakin 2005]. The scholar claimed that the constituents of a phrase are the core word (hereinafter K (Kernel)) and the adjunct (hereinafter A). V.D. Arakin suggests the following codes to mark the parts of speech, in particular, n (noun), v (verb), d (adverb), a (adjective), and prep (preposition).

Results and Discussion

At the preliminary stage of the research 200 STUs were retrieved from the video texts (BKA and CAB).

At Stage 1 the obtained STUs were classified into one-word STUs and word combinations. The former were further grouped into the parts of speech, whereas the latter were accorded with their structural type. Among 84 one-word STUs, 60 were nouns and 24 – adjectives. E.g. **tibia, abdomen, atrium, vasoconstrictors, transfemoral, transesophageal**. Multiword STUs were classified into nominal (72)¹ and verbal (35) types [Arakin 2005]. For example, the STU ‘**to secure cannula**’ is marked as $K^v + A^n$ (see Table 1).

Table 1

Structural types of multi-word STUs

Таблица 1

Структурные типы многословных хирургических терминологических единиц

The type	Number of STUs
Nominal word combinations	
$A^{a/n} + K^n$	67
$K^n + A^{a/n}$	5
Verbal word combinations	
$K^v + A$	35

¹ Hereinafter the numbers in brackets indicate the frequency of the STUs in the given group.

According to Table 1, the vast majority of the STUs are nominal word combinations (67) with the adjunct in preposition ‘ $A^{a/n} + K^n$ ’ (67), e.g. **transtibial amputation, ankle disarticulation, thoracic cavity, intercostal space, periosteal elevator, cardioscopic microscope** (CAB, BKA). The word combinations with postpositional adjunct ‘ $K^n + A^{a/n}$ ’ (5) are less frequent and nominate anatomical terms borrowed from Latin, e.g. **tibialis anterior, extensor hallucis longus, extensor digitorum longus, peroneus tertius muscles** (CAB, BKA).

The verbal combinations follow the pattern ‘ $K^v + A$ ’ (35), e.g. **to identify vessels, to close the wound, to inject heparin, to open pericardium, to expand area** (CAB, BKA).

The prevalence of nominal phrases among the STUs obtained at this stage suggests that in medical surgical discourse the manipulations of a cardiac bypass and lower leg amputation require more description than narration. The revealed nominal phrases are, primarily, the names of anatomical structures involved in the procedures. It may explain the lists of enumerations made by the surgeons.

At Stage 2 we focused on the semantics of the revealed verbs and verbal collocations. The componential analysis determined six prevailing verbal semes of the STUs, namely, ‘to open’, ‘to close’, ‘to introduce’, ‘to remove’, ‘to connect’, and ‘to find’.

The seme ‘to open’ is the core one for the following phrases: **to make incision, to expand the cut area, to expose the pericardium, to transect the anterior compartment structures, to levate the perosteal flap** (CAB, BKA).

The opposite meaning ‘to close’ is represented by the word combinations **to apply suture, to ligate the anterior tibial vessels, to sew the wound, to apply soft dressing** (CAB, BKA).

The seme ‘to introduce’ is revealed in the phrases **to inject heparin, to let in warm blood, to insert wires, to pump back blood** (CAB, BKA).

The STUs with the core meaning to ‘remove’ are as follows, **to detach tubes of heart-lung machine, to clean tissue, to reverse heparin, to divide the tibia, to trim back fibula, to chamfer anterior surface of tibia, to cauterize bleeding points** (CAB, BKA).

The terms denoting ‘the connection’ refer to vascular anastomosis, i.e. **to connect both cannulae, to anastomose graft with aorta** (CAB, BKA).

The seme ‘to find’ is represented in the STUs **to identify the anterior tibial vessels, to locate the tibio-peroneal trunk** (CAB, BKA).

We may presume that the highlighted verbs are essential for the described surgical work as they encompass basic actions taken to restore the blood flow and perform the amputation. Moreover, the vast majority of the studied verbal phrases nominate the processes of opening, closing and removing the tissues by a variety of verbs. The detailed classification, comparison and contrasting of these verbs may be regarded as a research perspective.

At Stage 3 we performed semantic classification of the STUs based on the core semes. The units fall into seven groups, namely, Stages of surgery (92), Anatomy (66), Devices and instruments (53), Problems (32), Types of CAB (18), Complications (17), Types of amputation (15) (see Fig. 1).

Evidently, the most frequent STUs belong to the semantic groups ‘Stages of surgery’ (92), ‘Anatomy’ (66) and ‘Devices and instruments’ (53) as these notions are crucial when dealing with the patient in the operating theatre performing both, CAB and the amputations.

The semantic group ‘Stages of surgery’ (92) may be exemplified by the following STUs: **to find mammary artery, clean and cut branches, to take graft, to insert the wires of pacemaker, to divide the interosseus membrane, to close the wound**. E. g. ES10 ‘*In patients undergoing coronary artery revascularisation, epicardial implantable cardioverter defibrillator (ICD) patch electrodes and rate sensing leads can be placed at the time of surgery*’ (OHCS), ES12 ‘*The injured leg was subsequently amputated, later followed by amputation of the other leg*’ (OHCS).

The specifics of the selected medical topics for the study, i.e. CAB and BKA predetermine the range of STUs pertaining to the group ‘Anatomy’ (66). Thus in the surgeons’ texts we encounter many names of the blood vessels, soft tissues of the chest and lower extremities, bones and heart structures. E.g. **femur, soleus, knee joint, ankle, left greater saphenous vein, myocardium, thoracic cavity, superior vena cava**. E.g. ES24 ‘*The splitting on the shaft of the tibia again follows the collagen fibre orientations, but that on the head of the femur seems more likely to be structural on a larger scale due to the rounded shape of the femur head*’ (OHCS), ES9 ‘*Diabetic patients may have a damaged myocardium due to extensive atheroma and/or small-vessel cardiomyopathy before infarction*’ (OHCS).

The nominations of the ‘Devices and instruments’ (53) encompass various tools and items used during all the stages of the surgical intervention and involve

patient’s vital functions monitoring devices (**the indicators, monitors**), tools for examination (**the ECG, the endoscope, the fluoroscope, the X-ray**), surgical instruments (**the scalpel, the oscillating bone saw, large amputation blade, the drill, the clamps, the retractors**), solutions (**heparine**). E.g. ES37 ‘*A laser knife has many advantages over the scalpel – it can make a much finer cut, and causes less bleeding*’ (OHCS).

Possible ‘Problems’ (32) and ‘Complications’ (17) that may arise in the surgery comprise, in particular, **uncontrolled necrotizing infection, plaques, malignant bone tumors, loss of blood supply**. E.g. ES30 ‘*However, it is difficult to be completely sure of the absence of vascular disease on clinical grounds alone and, for this reason, some groups have studied platelet function in patients*’ (OHCS).

Two semantic groups focus on the ‘Types of surgeries’, i.e. CAB (18) and BKA (15). The example STUs are as follows, **minimally-invasive direct coronary artery bypass grafting, transtibial amputation, ankle disarticulation, digit amputation**. E.g. ES42 ‘*An exercise test performed periodically should be able to detect the development of new coronary lesions, so that these can be acted upon at an early stage, either by angioplasty or by coronary artery bypass grafting if this is appropriate*’ (OHCS).

Evidently, the frequency of the nominations of the surgical stages is due to the detailed description given by the surgeons. It entails the names of the involved anatomical parts and devices. The revealed three prevailing semantic groups are in logical connection and viewed as an integral part of the complex manipulations performed. In other words, a surgeon cannot but describe his actions naming the tissues and the instruments used.

At Stage 4 we resorted to the Oxford handbook of clinical surgery (OHCS) to reveal the contextual specifics of two surgical manipulations studied and key STUs related. The analysis rested on the AntConc tool (AntConc). The KWIC word

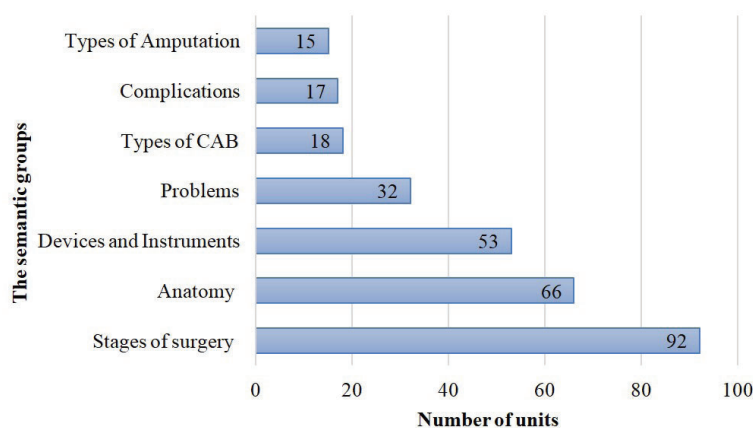


Figure 1 – Semantic groups of the STUs

Рисунок 1 – Семантические группы хирургических терминологических единиц

colectomy 748 Stoma formation 750 Wide local excision—breast 752 Below knee	amputation 754 730	CHAPTER 21 Common operations Diagnostic laparoscopy Indications (typical)
to knee joint to promote range of movements. BELOW KNEE	AMPUTATION 755	Complications (specific to the procedure) • Flap necrosis, <5%. • Haematoma. S
10–12cm 2/3 circumference 1/3 circumference Fig. 21.9 Flaps used of below knee	amputation. (a) Long posterior flap. (b) Skewed symmetrical flaps. This
is page intentionally left blank 754 CHAPTER 21 Common operations Below knee	amputation	Indications (typical) • Unreconstructible peripheral vascular disease of distal lim
shaped curve 6 brainstem death 16, 685–99 Askanazy cell tumour 759 below knee	amputation 662,	brainstem reflexes 685–99 aspiration cytology 663, 754–5 branchial cyst, sinus a
for trauma or tissue necrosis above high thigh. • Above knee	amputation (AKA). Bone transected at junction of upper two-thirds
thirds heal and more achieve walking than with above-knee	amputations.	Types • Hip disarticulation. Rarely needed, but indicated for trauma
wide stump, which is difficult for prosthesis fit. • Below-knee	amputation (BKA). Weight bearing on patellar tendon with good prosthetic
noebiasis/amoebic liver ABO antigens 97 lung 632 abscess 706–7 above the knee	amputation	oesophagus 282 AMPLE history 479 662 prostate 378–9 ampullary carcinoma 3;
lymitis 366 thrombus 154 indications for 682 tubo-ovarian infection through knee	amputation	islet cell 695 306, 307 662, 663 liver 682, 696–7 tubulo-dermoid cysts 150 thumt
ally good for wheelchair- dependent patients. AMPUTATIONS 663 • Through-knee	amputation (TKA). Produces a wide stump, which is difficult for
risk of malignancy increases with size. Chopart's amputation An	amputation	made through the tarsal bones. Churg–Strauss syndrome Affects
fracture-dislocations (Lisfranc)1 Jacques Lisfranc de Saint-Martin described an	amputation	technique across the five TMT joints as a solution
ecrosis—hyperkalaemia, acidosis, acute renal failure, and cardiac arrest). Consider	amputation	if ischaemic changes advanced and life-threatening. Surgery to
ularization if appropriate. • Angioplasty. • Femoro-distal bypass grafts. • Consider	amputation	for failed medical or surgical treatment. • Often possible to
below knee or above knee in smoking-related atherosclerosis. • Distal	amputations (toe, forefoot, ankle) may be appropriate in diabetic disease. •
medical or surgical treatment. • Often possible to do limited distal	amputations (e.g. transmetatarsal). • May be progressive if disease spreads.
od supply, hence systemic antibiotic penetration. • Unresolving cases may require	amputation.	Secondary to trauma (open fractures) • Prevention by early aggressive
nerves may be permanently anaesthetic. Severely damaged limbs may require	amputation. 726	CHAPTER 20 Surgery in tropical diseases Guinea worm infestation Key

Figure 2 – Concordance lines of the STU **amputation** in the AntConc tool

Рисунок 2 – Линии соответствия хирургической терминологической единицы **ампутация** в инструменте AntConc

search generated 46 hit concordance lines for the word ‘amputation’ in all its forms (see Fig. 2). Comparatively, only 5 hits were obtained for the key phrase ‘coronary bypass’.

Given the frequency of the distribution of the STU **amputation** we conducted further study which involved the range of its possible collocates. Thus, in the texts of OHCS the word **amputation** is preceded by the following units: knee (11), below (6), Chopart (2), above (3), require (3), limb (3), wide (2), and bypass (2) (see Fig. 2). E.g. ES45 ‘Chopart’s **amputation** is an amputation made through the tarsal bones’ (AntConc). +

857 hits were obtained for the collocates of the term ‘surgery’. The most frequent are the word combinations orthopaedic (58), cardiac (26), gastrointestinal (24), colorectal (22), pediatric (21), breast (21), plastic (20), and invasive (16) surgery. E.g. ES40 ‘A systematic approach to assessing post-operative cardiac **surgery** patients is vital’ (AntConc).

The key word **incision** generated 135 concordance lines which highlighted the combinations with the words skin (26), transverse (19), to make (16). E. g. ES 48 ‘Do not extend the skin **incision** beyond the wrist crease to protect the palmar cutaneous branch of the median nerve’ (AntConc).

The concordance lines generated for the key STUs are effective for the visual representation of the word combination and their contextual use. The method may be effective for the dictionary entries compilation as well as for the foreign language studies.

Conclusion

The obtained results suggest the frequency of the nominal multi-word STUs. Moreover, one-word terms are also, primarily, nouns, nominating anatomical parts. Verbal STUs are used to verbalize surgeon’s actions during the surgery.

The meanings of major verbs also pertain to the nominations of the stages of surgery, when dealing with body tissues, liquids and surgical tools. The semes in question are ‘to open’, ‘to close’, ‘to introduce’, ‘to remove’, ‘to connect’ and ‘to find’.

The respective semantic group of the STUs, namely, ‘The stages of surgery’ is the most represented one, along with the nominations of ‘The anatomical structures’ and ‘The devices’.

According to the concordance lines analysis, performed via AntConc tool, the STU **surgery** collocates with the body systems and the types of surgery, such as invasive, noninvasive, etc. The distribution of the term **amputation** encompasses the names of limbs and performance methods. The word combinations with term **incision** are both verbal (**to make incision**), and nominal (**a horizontal incision, skin incision**).

The research perspective implies the study of the prolonged list of the STUs, the application of the introduced algorithm to the study of different terminological units within and beyond medical domain. All the example sentences collected for the study may be extended and combined into the corpus, ranged with certain medical area marker. Moreover, the STUs may be grouped into a glossary or medical thesaurus.

Materials of the research

BKA – *Below Knee Amputation*. URL: <https://www.youtube.com/watch?v=G9IR-bHv4sM> (accessed: 10.07.2023).

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