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ABSTRACT

SURGICAL OUTCOMES FOR STENOTIC-OCCLUSIVE VASCULAR LESIONS IN EXTRACRANIAL AND LOWER LIMB ARTERIES

Petro Bodnar
https://orcid.org/0000-0001-9285-6516
L.Ya. Kovalchuk Department of Surgery No.1, Urology, Minimally Invasive Surgery, I. Horbachevsky Ternopil National Medical University, Ternopil, Ukraine

Anatoliy Bedeniuk
https://orcid.org/0000-0003-1649-7886
L.Ya. Kovalchuk Department of Surgery No.1, Urology, Minimally Invasive Surgery, I. Horbachevsky Ternopil National Medical University, Ternopil, Ukraine

Tetiana Bodnar
https://orcid.org/0000-0002-5507-5363
L.Ya. Kovalchuk Department of Surgery No.1, Urology, Minimally Invasive Surgery, I. Horbachevsky Ternopil National Medical University, Ternopil, Ukraine

Liudmyla Bodnar
https://orcid.org/0000-0001-9173-930X
Internal Medicine Department No.3, I. Horbachevsky Ternopil National Medical University, Ternopil, Ukraine

Background: Narrowing or blocking blood vessels in the neck and legs can lead to life-threatening consequences, including stroke, insufficient blood supply to the legs, and delayed wound healing.

Methods: A systematic literature review was conducted using the Cochrane database from 2019 to 2024. Thirteen relevant studies were included using MeSH keywords, encompassing randomized controlled trials (RCTs) and cohort studies.

Results: This review analyzed data from 13 studies conducted between 2019 and 2023, with diverse sample sizes and follow-up durations. A major RCT in 2019 involved 4,754 participants and a follow-up period of 12.4 years. All studies focused on stenotic-occlusive vascular lesions in peripheral lower limb and extracranial arteries. Surgical interventions included bypass surgery, endarterectomy, and endovascular stenting. Outcomes demonstrated high primary patency rates, improved ankle-brachial index (ABI), limb salvage, and enhanced functional results, such as increased walking distance and better quality of life. For instance, SUPERA stenting reported 100% primary patency at 12 months and a procedural success rate exceeding 98%. Complications, including infection, thrombosis, and bleeding, were noted but with low periprocedural mortality. Success rates depended on patient-specific factors and precise surgical planning. Additional follow-up revealed that long-term durability of surgical techniques varied across patient groups, emphasizing the importance of tailored management.

Conclusion: Surgical procedures, including bypass surgery, angioplasty, stenting, and endarterectomy, are highly effective for treating arterial occlusion or stenosis. These approaches significantly improve survival chances and functional outcomes while reducing risks when proper management is ensured. Advancing surgical

Bohdana Verveha
https://orcid.org/0000-0002-7463-5899
Department of Pathological Physiology, Danylo Halytsky Lviv National Medical University, Lviv, Ukraine

techniques remains critical for enhancing vascular intervention success rates.

Keywords: vascular diseases, arterial occlusive diseases, carotid artery diseases, vascular surgical procedures, limb salvage, treatment outcome.

Corresponding author: *Petro Bodnar, L.Ya. Kovalchuk Department of Surgery No.1, Urology, Minimally Invasive Surgery, I. Horbachevsky Ternopil National Medical University, Ternopil, Ukraine, e-mail: bodnarpj@tdmu.edu.ua*

РЕЗЮМЕ

Петро Боднар
https://orcid.org/0000-0001-9285-6516
Кафедра хірургії №1 з урологією та малоінвазивною хірургією імені професора Л.Я. Ковальчука, Тернопільський національний медичний університет імені І.Я. Горбачевського, м. Тернопіль, Україна

Анатолій Беденюк
https://orcid.org/0000-0003-1649-7886
Кафедра хірургії №1 з урологією та малоінвазивною хірургією імені професора Л.Я. Ковальчука, Тернопільський національний медичний університет імені І.Я. Горбачевського, м. Тернопіль, Україна

Тетяна Боднар
https://orcid.org/0000-0002-5507-5363
Кафедра хірургії №1 з урологією та малоінвазивною хірургією імені професора Л.Я. Ковальчука, Тернопільський національний медичний університет імені І.Я. Горбачевського, м. Тернопіль, Україна

Людмила Боднар
https://orcid.org/0000-0001-9173-930X
Кафедра внутрішньої медицини №3, Тернопільський національний медичний університет імені І.Я. Горбачевського, м. Тернопіль, Україна

Богдана Вервега
https://orcid.org/0000-0002-7463-5899
Кафедра патологічної фізіології, Львівський національний медичний університет імені Данила Галицького, м. Львів, Україна

ХІРУРГІЧНІ РЕЗУЛЬТАТИ ПРИ СТЕНОТИЧНО-ОКЛЮЗІЙНИХ УРАЖЕННЯХ ЕКСТРАКРАНІАЛЬНИХ АРТЕРІЙ ТА АРТЕРІЙ НИЖНІХ КІНЦІВОК

Передумови: Звуження або блокування кровоносних судин шиї та ніг може спричинити небезпечні для життя наслідки, зокрема інсульт, недостатнє кровопостачання нижніх кінцівок та уповільнене загоєння ран.

Проведено систематичний огляд літератури з використанням бази даних Cochrane за період 2019–2024 років. До аналізу включено тринадцять релевантних досліджень за ключовими словами MeSH, зокрема рандомізовані контрольовані дослідження (РКД) та когортні дослідження.

Результати: У цьому огляді проаналізовано дані 13 досліджень, проведених у період із 2019 по 2023 рік, з різними розмірами вибірок і тривалістю спостереження. Наймасштабніше РКД у 2019 році охоплювало 4 754 учасники, а період спостереження становив 12,4 року. Усі дослідження були зосереджені на стенозуючих оклюзійних ураженнях периферичних артерій нижніх кінцівок та екстракраніальних артерій. Хірургічні втручання включали шунтування, ендартеректомію та ендоваскулярне стентування.

Результати показали високі показники первинної прохідності, поліпшення гомілково-плечового індексу (ABI), збереження кінцівки та поліпшення функціональних результатів, таких як збільшення відстані ходьби та покращення якості життя. Наприклад, при стентуванні SUPERA зафіксовано 100% первинну прохідність через 12 місяців, а показник успішності процедури перевищив 98%.

Ускладнення, включаючи інфекції, тромбози та кровотечі, були зафіксовані, але супроводжувалися низькою перипроцедурною смертністю. Показники успіху залежали від індивідуальних особливостей пацієнта і ретельного хірургічного планування.

Додаткове спостереження виявило, що довгострокова ефективність хірургічних методів у різних групах пацієнтів була різною, що підкреслює важливість індивідуального підходу до лікування.

Висновок: Хірургічні процедури, зокрема шунтування, ангіопластику, стентування та ендартеректомію, є високоефективними для лікування артеріальної оклюзії або стенозу. Ці підходи значно підвищують шанси на виживання та покращують функціональні результати, водночас знижуючи ризики за умови забезпечення належного менеджменту. Удосконалення хірургічних методів залишається критично важливим для підвищення рівня успішності судинних втручань.

Ключові слова: судинні захворювання, оклюзійні захворювання артерій, захворювання сонних артерій, судинні хірургічні процедури, збереження кінцівок, результат лікування.

Автор, відповідальний за листування: *Петро Боднар, кафедра хірургії №1 з урологією та малоінвазивною хірургією імені професора Л.Я. Ковальчука, Тернопільський національний медичний університет імені І.Я. Горбачевського, м. Тернопіль, Україна, e-mail: bodnarpj@tdmu.edu.ua*

INTRODUCTION / ВСТУП

The systemic condition affecting multiple arterial beds including carotid, coronary and lower limb arteries is atherosclerosis with the outcome of stenotic or occlusive lesions. These include stroke, limb ischemia, and delayed wound healing that are dangerous risks calling for operative procedures to restore normal blood flow so as to stop complications [1]. Peripheral arterial disease is a common circulatory disorder characterized by the presence of atheromatous plaques or thrombi blocking arteries causing ischemia. The prevalence of PAD varies across various ethnic groups with 3.5% among whites and 3.7% among Asians rates rising to as high as 6.7% in blacks. Over half of all patients suffer significant reduction in ambulation status due to PAD. The mortality rate associated with PAD is much higher than matched controls where five-year mortality rate being about 30% for those who have intermittent claudication and up to one quarter within twelve-month period for individuals presenting critical limb ischemia [2].

Surgical choices for treating carotid artery stenosis are basically, carotid endarterectomy and carotid artery stenting. CEA surgically removes the plaque from the artery while CAS widens the narrowed blood vessel by using a stint [3]. The clinical diagnosis of the disease can lead to serious morbidity and even death if it remains untreated. Extracranial arterial stenotic-occlusive lesions in combination with the lower limb can cause this condition. In cases when these vessels are narrowed or blocked, blood flow through the collateral vessels becomes restricted, which increases the risk of developing peripheral arterial conditions such as anaemia stroke. The use of operative treatments provides an alternative promising approach for better patient experiences with regard to improvement in quality life [4].

Carotid endarterectomy or carotid artery stenting plays pivotal role in stroke prevention by reestablishing normal blood flow to the brain as a result of significant extracranial vascular lesions primarily affecting the carotid arteries. The decision on which way to go will depend on various factors including stenosis level, anatomical peculiarities and general health status of the patient [5]. Lower limb arterial occlusive disease is predominantly PAD which affects millions of people worldwide causing symptoms such as claudication and rest pain. Critical limb ischemia may result in severe conditions. Bypass grafting, endarterectomy, and angioplasty as well as stenting are examples of surgical options in lower limb revascularization. The decision on a particular procedure depends on certain features among them being the site(s) of stenosis or occlusion(s), their degrees or loads, concurrent morbidities [6].

A study, for instance, suggests that among surgical patients, certain physiological markers of PTSD such as autonomic diseases can offer global views [7]. Another one also seeks to find out if there is any chance in the application of alternative forms like computer and video games therapy for addressing some psychological factors that can indirectly enhance surgical results [8]. Moreover, for those with carotid stenosis, ACS patients have more cardiovascular events than conservative treatment and results of surgical revascularization are indistinguishable from conservative treatment [9]. It is equally important that laws are consistent with EU standards in order to protect patients against fake drugs during the pandemic [10]. A comprehensive review confirms the efficacy and patient compliance when it comes to determining DVT (deep vein thrombosis) using MRI (magnetic resonance imaging) respectively thus making useful clinical contributions [11]. Moreover, even if it is not acknowledged, there are many reasons why synthetic iron citrate can play a role in hematologic responses in an operation setting [12]. The pandemic saw a migration to remote learning, which sought to improve the assessment process to determine the effectiveness of surgery students carried out [13]. Ideas of philosophy on education imply that interdisciplinary approaches are needed and this calls for elaborate surveys into the outcomes of surgical interventions [14, 15]. Additionally, there are technological advancements such as AI and blockchain that show possibilities for improving surgeries [16]. Finally, in the midst of contemporary academic interruptions arising from COVID-19, digital knowledge management is becoming more important than ever before and therefore efficient digital strategies are required [17]. They also contribute to the deepening of

our knowledge about vascular factors that affect the results of surgical interventions.

Research Problem

The world is experiencing an extensive prevalence of extracranial and lower limb occlusive arterial stenotic vascular lesions whose critical medical problem is still unresolved. Besides, they raise the chances for stroke, transient ischemic attack as well as peripheral artery disease leading to reduced quality life which may lead to loss of limbs if not attended to. However, it is important that surgical outcomes are evaluated in order to achieve excellent patient care and long-term results.

Research Focus

This review therefore analyzes current literature; procedural advances; postoperative discoveries that will help evaluate the effectiveness/safety profiles associated with surgery techniques and investigate the influences of surgical decision making & long-term outcome on patients thus improving treatment modalities for these challenging vascular conditions.

Research Aim

The aims of this systematic review are to:

1. Compare surgical approaches, such as bypass surgery and minimally invasive techniques e.g. stenting in the treatment of vascular blockages.
2. Assess how well surgical treatments can keep artery function up over a long period.
3. Determine what individual characteristics influence success or failure after surgery.
4. Compare outcome with two different surgical approaches like stents or endarterectomy.

MATERIALS AND METHODS

Study Design

A systematic review was conducted to synthesize and analyze existing evidence on the research topic.

Search Strategy

Figure 1 shows the systematic review process conducted using the Cochrane database, focusing on studies related to keywords such as (Stenosis, “Occlusive vascular disease”, “Vascular occlusion” OR “Arterial occlusion”) AND (“Carotid artery”, “Vertebral artery” OR “Subclavian artery” OR “Brachiocephalic artery” OR “Femoral artery” OR “Popliteal artery” OR “Tibial artery” OR “Peroneal artery”) AND (Surgery OR “Surgical treatment” OR “Surgical procedures” OR “Postoperative outcomes” OR “Clinical outcomes”) AND (Angioplasty OR Endarterectomy OR “Bypass surgery” OR Stenting OR Revascularization) AND (Adults OR Elderly OR “High-risk patients” OR Comorbidities) AND (Mortality OR Morbidity OR Complications OR “Patency rates” OR “Quality of life”). Initially, 356 records were identified, and 253 were excluded based on the years 2019–2024 and 2 based on language filters (English). An additional 67 irrelevant records were removed. Ultimately, 34 records met the eligibility criteria, with 13 highly relevant studies meeting the inclusion criteria for this systematic review. This diagram offers a structured view of the comprehensive selection process undertaken to identify pertinent studies aligned with this systematic review's scope and objectives.

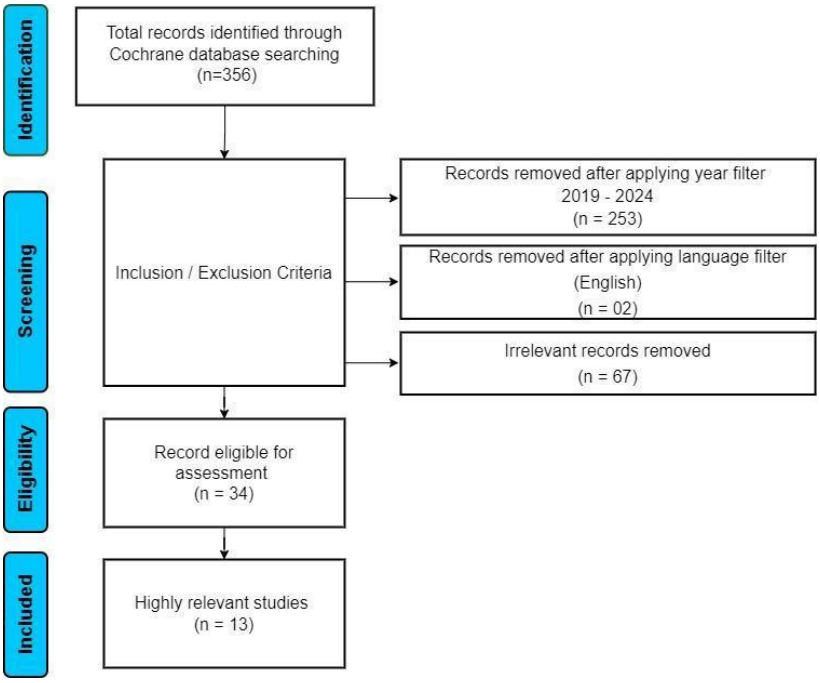

Figure 1 – PRISMA Flow Diagram

Inclusion and Exclusion Criteria

This systematic review includes studies involving adult and elderly human populations at high risk or with comorbidities related to stenotic-occlusive vascular lesions in extracranial and lower limb arteries. Eligible studies must report on surgical interventions such as angioplasty, endarterectomy, bypass surgery, stenting, revascularization or other surgical interventions by considering outcomes like postoperative outcomes, clinical outcomes, mortality rates, morbidity rates or complications rate patency rates or quality of life assessments. Only studies published in English between 2019 and 2024 are considered. Excluded are studies published before 2019 or after 2024, as well as those not published in English. Moreover, animal studies will not be considered for this review; also excluded are systematic reviews without original data sets; editorials; letters; conference abstracts and any study that does not clearly report relevant outcome data about surgical results or prognosis of patients suffering from vascular stenotic occlusive lesion thereby ensuring that the review focuses on robust human-based research consistent with its purpose.

Data Extraction

For standardization, two independent reviewers used a standardized form to collect data from previous studies on surgical results for stenotic-occlusive lesions in extracranial and lower limb vessels. They considered patient demographics, study design and outcome measures as well as mortality rates associated with sepsis detection.

Quality Assessment

Figure 2: the risk of bias evaluation for RCT studies with Cochrane's risk-of-bias tool (RoB 2) assesses different types of biases from several studies in terms of randomization, deviations from intended interventions, missing outcome data, measurement of the outcome, selection of reported results and overall bias. The color-coded outcomes show that majority of the research demonstrates a low risk in all categories as indicated by green while some show concerns about randomness and actual measurement recorded by yellow colors. Summing up their quality assessments on this point, most articles generally give evidence towards low bias which means that results obtained can be considered to be reliable and valid.

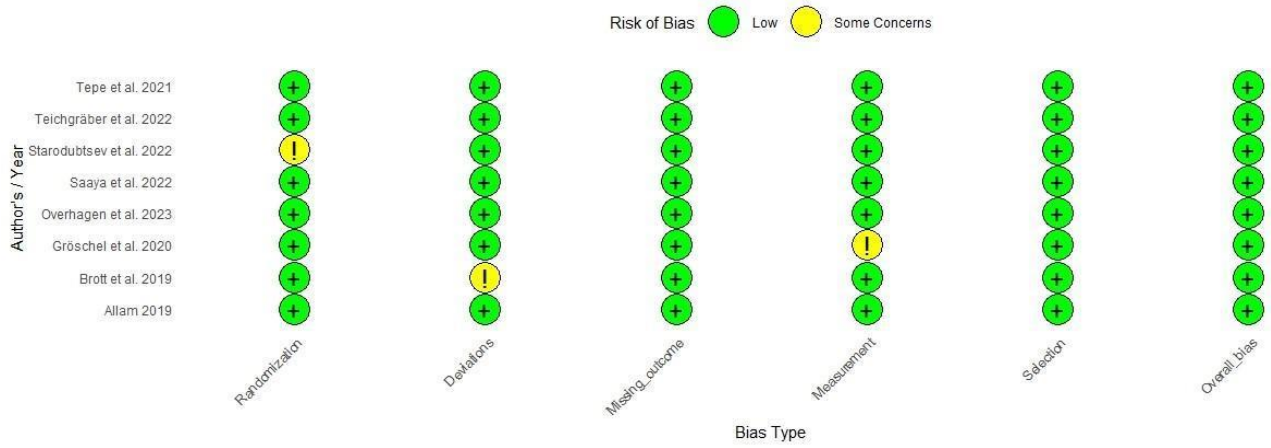

Figure 2 – Risk of bias assessment of RCTs included studies

Figure 3 shows the risk of bias for cohort studies using the ROBINS-I tool, where seven types of bias were evaluated and these include confounding, selection of participants, classification of interventions, deviations from intended interventions, missing data, measurement of outcomes and selection of the reported result. Three colors used to show risk bands: low risk (Green), moderate risk (Yellow) and high risk (Red). There is a mixture of green (low) and yellow (moderate) risks across different categories in most of the studies. The study shows that all studies have a low risk for the classification of interventions and selection of the reported result. In one study, however, there was a high risk in the selection of participants (red). Generally, deviations from intended intervention and missing data risks remain mostly at a low level (green) occasionally reaching a moderate level (yellow). Different levels of bias are seen in these studies with most being either low or moderate but with an identified instance having a very high risk.

RESULTS

The research designs that are being dealt with include RCTs and cohort studies in Table 1. These studies have different sample sizes and durations for follow-up. In the year 2019, an RCT was conducted with a follow-up period of twelve months while another took place in 2020 for the same duration. Another study

that was done in the year 2022 as a cohort involved answering questions that must be answered within one year, and another was carried out during the same period but had to give information extending to two years' time span. Moreover, there is an RCT from 2022 which had a longer follow- up duration of forty-eight months while there was also another provided by 2021 with only thirty days for an answer. Other studies including such smaller cohorts as a 2023 cohort study and a smaller one in 2021 differ considerably in terms of follow-up duration for instance. For example, a major RCT conducted in 2019 followed up its large sample size of about four thousand seven hundred fifty-four participants over a period which lasted around twelve point four years. This suggests that researchers evaluate outcomes differently depending on their fields using various approaches over varying periods of time concerning study designs population sizes, and durations of monitoring.

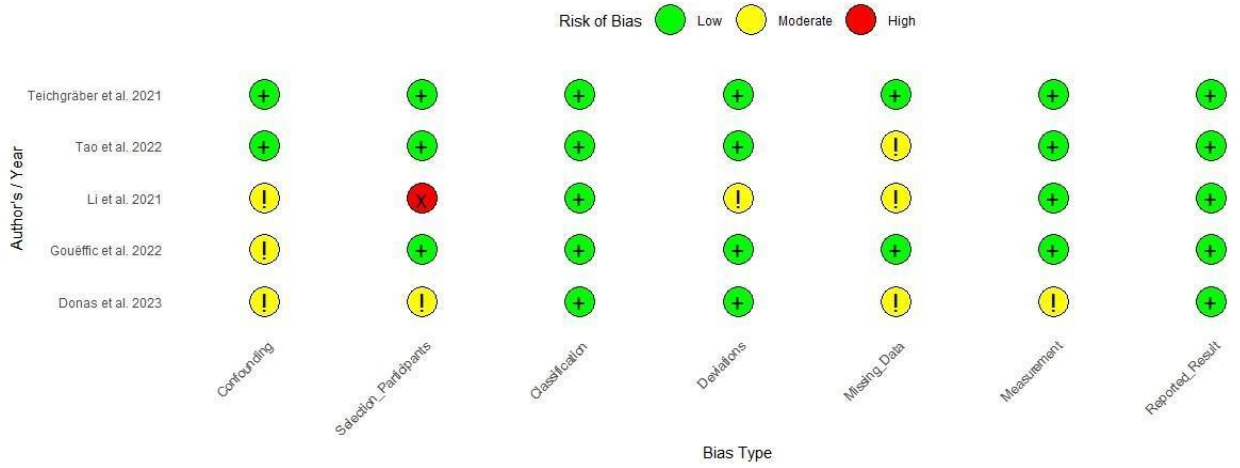

Figure 3 – Risk of bias assessment of cohort included studies

Table 1 – Study Characteristics

Authors / Year	Study Design	Sample Size	Year	Duration of Follow-up
Allam 2019 [18]	RCT	90	2020	12 months
Gouëffic et al. 2022 [19]	Cohort	150	2022	12 months
Teichgräber et al. 2021 [20]	Cohort	300	2021	2 years
Tao et al. 2022 [21]	Cohort	69	2022	12 months
Donas et al. 2023 [22]	Cohort	62	2023	-
Saaya et al. 2022 [23]	RCT	238	2022	48 months
Tepe et al. 2021 [24]	RCT	306	2021	30 days
Overhagen et al. 2023 [25]	RCT	201	2023	12 months
Brott et al. 2019 [26]	RCT	4754	2019	12.4 years
Starodubtsev et al. 2022 [27]	RCT	202	2022	36 months
Li et al. 2021 [28]	Cohort	75	2021	90 days
Teichgräber et al. 2022 [29]	RCT	230	2022	36 months
Gröschel et al. 2020 [30]	RCT	158	2020	12 months

Table 2 is a summary of the details regarding surgical interventions for stenotic-occlusive vascular lesions in extracranial and lower limb arteries across studies. The timelines for these interventions ranged from 2019 to 2024, with several types of surgeries targeting the specific affected vessels and some involving multiple areas at once. In the lower limb, the main reasons for surgery are critical limb ischemia,

claudication, and peripheral artery disease. Open surgical approaches like endarterectomy or bypass surgery were employed but also minimally invasive balloon angioplasty, stenting, rotational atherectomy and others. However, carotid artery stenosis in most cases is found in diseased carotids that cause symptoms thus, treatment may be done by use of carotid endarterectomy or alternatively carotid artery stenting having some patients being treated with best medical therapy as compared to other two options analyzed. With ever-changing modes of operation during vascular surgery towards increased success rates due to focusing on factors related to location of lesion and individual specifics.

Table 2 – Surgical Intervention

Authors / Year	Location of Lesion	Indications for Surgery	Type of Surgery	Surgical Technique
Allam 2019 [18]	Lower limb	Disabling claudication and limb ischemia	PTA	Endovascular therapy
Gouëffic et al. 2022 [19]	Lower limb	Critical limb ischemia, claudication	Endarterectomy, bypass, angioplasty	Open surgery and minimally invasive techniques
Teichgräber et al. 2021 [20]	Lower limb	Critical limb ischemia	Bypass surgery	Open surgery
Tao et al. 2022 [21]	Lower limb	Stenosis or occlusive disease	Endovascular stenting	Minimally invasive endovascular
Donas et al. 2023 [22]	Lower limb	Claudication or critical limb ischemia	Endovascular treatment + PTA	Minimally invasive endovascular
Saaya et al. 2022 [23]	Lower limb	Intermittent claudication	Endovascular recanalization with stenting	Endovascular procedures + Open surgical technique
Tepe et al. 2021 [24]	Lower limb	claudication or rest pain	Endovascular treatment	PTA or IVL
Overhagen et al. 2023 [25]	Lower limb	Chronic limb-threatening ischemia	Endovascular intervention	PTA
Brott et al. 2019 [26]	Extracranial	Symptomatic carotid stenosis	carotid endarterectomy	Open surgery
Starodubtsev et al. 2022 [27]	Lower limb	Chronic limb ischemia	hybrid repair	Endarterectomy
Li et al. 2021 [28]	Extracranial	Acute ischemic stroke with NIHSS score ≥6	Endovascular treatment	Angioplasty alone or acute stenting
Teichgräber et al. 2022 [29]	Lower limb	Chronic limb-threatening ischemia	Angioplasty	Minimally invasive
Gröschel et al. 2020 [30]	Extracranial	Ischemia	Carotid endarterectomy	Open surgery

Table 3 shows the primary and secondary outcomes as well as complications of various studies on surgical interventions for stenotic occlusive vascular diseases in extracranial and lower limb vessels. Primary outcomes commonly reported include patency rates at different intervals (e.g., 1, 6, 12 months), procedural success rates, and limb salvage rates. Secondary outcomes often include clinically driven target lesion revascularization rates, amputation rates, mortality rates, and functional outcomes such as ankle-brachial index improvement. Complications varied across studies but frequently involved acute thrombosis, infection, bleeding, and major adverse events such as vessel perforation and embolization. Notably, SUPERA stents achieved a primary patency rate of 100% at one year while other studies reported a procedural success rate more than or equal to 98%. Several reports revealed complications like infection and bleeding with some indicating low peri-procedural mortality and morbidity rates were noted. The findings illustrate that surgical interventions can achieve high patency and limb salvage rates although the occurrence of complications reveals the significance of careful perioperative management.

Table 3 – Outcomes

Authors / Year	Primary Outcomes	Secondary Outcomes	Complications
Allam 2019 [18]	Patency rates at 1, 6, and 12 months	6 and 12-month cd-TLR, limb salvage	Acute thrombosis, vessel perforation + mortality
Gouëffic et al. 2022 [19]	Patency rates, limb salvage rates	Amputation rates, mortality rates	Infection, bleeding, thrombosis
Teichgräber et al. 2021 [20]	1-year patency: 80%, 2-year limb salvage: 90%	2-year amputation: 10%, 2-year mortality: 5%	Infection: 5%, bleeding: 3%, thrombosis: 7%
Tao et al. 2022 [21]	12-month SUPERA stents primary patency: 100%	Unrelated patient mortality, noted clinical improvements	NSTEMI, osteomyelitis, gastrointestinal bleeding
Donas et al. 2023 [22]	Procedural success 98.4%; ABI improvement	No major adverse events; 0% overall mortality	Peripheral embolizations: 3.7% in Jetstream, 5.7% in Phoenix
Saaya et al. 2022 [23]	Primary patency rates	Amputation + Mortality rates	Bleeding, thrombosis
Tepe et al. 2021 [24]	Procedural success, ≤30% residual stenosis	Revascularization, health-related quality of life	Perforation and embolization
Overhagen et al. 2023 [25]	12-month primary vessel patency, MAE-free rate	CD-TLR rates, wound healing, quality of life	Major adverse events, wound-related issues
Brott et al. 2019 [26]	Composite of stroke or death within 120 days	Major stroke, minor stroke,	Peri-procedural stroke or death, with some variability
Starodubtsev et al. 2022 [27]	Patency + limb salvage rates	Amputation rates, mortality rates, ABI improvement	Thrombosis, wound infections, bleeding
Li et al. 2021 [28]	Successful reperfusion	Mortality	Distal emboli events, restenosis carotid artery
Teichgräber et al. 2022 [29]	Patency + limb salvage rates	Major adverse limb	Infection, bleeding, thrombosis
Gröschel et al. 2020 [30]	New diffusion-weighted imaging lesions	Cardiovascular events, bleeding complications	Bleeding, wound healing complications

Table 4 summarizes surgical interventions for stenotic-occlusive vascular lesions in extracranial and lower limb arteries as presented in the functional outcomes of different studies.

These studies involve various procedures such as percutaneous transluminal angioplasty, endarterectomy, bypass surgery, endovascular stenting among others. In the studies some improvements were noted: clinical upgrades within Rutherford classification; increased ankle-brachial index; extended walking distances; improved quality of life measures; alleviation of symptoms and neurological recovery. Every operation has its own particular outcome with such procedures as rotational atherectomy followed by balloon angioplasty showing significant ABI improvement while EVA treatments had similar health utilities compared to walking capacities. In contrast, carotid artery stenting versus endarterectomy comparisons have focused on stroke incidence and quality of life measures. In general, the table is an all-inclusive depiction of functional benefits intrinsic to different surgical modalities used against stenotic-occlusive vascular diseases.

DISCUSSION

Current systematic review on surgical outcomes of stenotic-occlusive vascular lesions in extracranial and lower limb arteries have shown significant variations in the study designs, sample sizes, and follow-up durations. RCTs from 2019 and 2020 had participants followed up for 12 months, while a cohort study in 2022

had their follow-ups extended to one or two years. Notably, one RCT conducted in 2022 had a follow-up period of up to 48 months compared to another trial in the year 2021 which was only able to go as far as a month and a half. A major RCT carried out in 2019 stands out with over twelve years of observation involving four thousand seven hundred fifty-four subjects. These differences reflect the various ways different researchers employ when evaluating outcomes thereby illustrating how intricate and unstable this area is. In another review dealing with surgical treatment of occlusive carotid artery disease, it is reported that since the fifties, carotid endarterectomy has been employed most often. Despite having been used for long enough time there still exists much controversy among experts regarding such aspects as technical details and timing of the procedure that are ideal. In general risk associated with procedures is greater for open proximal carotid surgery than other endovascular therapies [31].

Table 4 – Functional Outcomes

Authors / Year	Type of Surgery	Functional Outcomes
Allam 2019 [18]	Percutaneous balloon angioplasty	Clinical improvement with one level upgrade in Rutherford classification, increased ABI
Gouëffic et al. 2022 [19]	Endarterectomy, bypass, angioplasty	Improved walking distance, quality of life
Teichgräber et al. 2021 [20]	Bypass surgery	Improved walking distance and quality of life measures
Tao et al. 2022 [21]	Endovascular stenting	Improved symptoms documented in 9 patients
Donas et al. 2023 [22]	Endovascular treatment using rotational atherectomy followed by balloon angioplasty	Improved ABI from 0.55 to 0.70 (Jetstream) and 0.50 to 0.95 (Phoenix)
Saaya et al. 2022 [23]	Endovascular recanalization with stenting vs remote endarterectomy	ABI improvement post-surgery
Tepe et al. 2021 [24]	Endovascular treatment (DCB or stent)	Comparable walking capacity and health utility between groups
Overhagen et al. 2023 [25]	Endovascular intervention (DES or PTA)	Improved Rutherford classification, quality of life improvement
Brott et al. 2019 [26]	CAS (carotid artery stenting) vs. CEA (carotid endarterectomy)	Typically measured by stroke incidence and quality of life metrics
Starodubtsev et al. 2022 [27]	HR (hybrid repair), OR (open reconstruction)	Improved walking distance, quality of life
Li et al. 2021 [28]	Endovascular treatment (EVT)	Modified Rankin scale scores, neurological recovery
Teichgräber et al. 2022 [29]	Angioplasty (sirolimus-coated balloon or plain old balloon)	Walking distance, quality of life
Gröschel et al. 2020 [30]	Carotid endarterectomy (CEA), carotid artery stenting (CAS), or best medical therapy (BMT)	Neurological status (NIHSS), DWI-MRI lesions, and long-term clinical outcomes

Similarly, another review shows that femoral endarterectomy is one of the surgical treatments with a high rate of technical success in the context of peripheral arterial disease. However, if inflow disease is not adequately treated or lesions are left behind, these surgical procedures can be quickly compromised. This review article is part of a bigger collection that consists of articles with different designs and study periods. Because of these, observations can be made on how effective surgery and endovascular interventions are in stenotic-occlusive vascular lesions [32]. In recent years, patient outcomes have been improved by improving surgical techniques and studying the long-term effects of various therapeutic approaches, among other things.

This current systematic review of surgical outcomes for stenotic-occlusive vascular lesions, addresses various surgeries in extracranial and lower limb arteries for critical limb ischemia, calculation and peripheral artery disease. Some of the open surgical options are endarterectomy, bypass while minimally invasive procedures performed include balloon angioplasty, stenting and rotational atherectomy. Carotid

endarterectomy, carotid artery stenting; best medical therapy for symptomatic carotid artery stenosis have been compared in the study. Therefore, success rates can be improved by focusing on lesion location as well as patient characteristics as argued by this review. Another research elaborates that in lower limbs either endarterectomy or bypass surgery which were classified under open surgical approaches are commonly used along with some other less stressful treatment methods like balloon angioplasty, stenting drug-coated balloons and rotational atherectomy. Mostly then an endarterectomy is recommended for common femoral artery but intervention through endovascular means is not often preferred due to higher restenosis rates and complications. For the femoropopliteal segment lesions less than 5 cm could be subjected to plain balloon angioplasty whereas drug-eluting stents can be opted for on short (<25cm) lesions [33]. While another study shows that Carotid artery stenosis is treated with carotid endarterectomy or carotid artery stenting in most cases, particularly those with symptoms as shown by another study. It was also found that best medical therapy alone may be sufficient for some of these patients [34]. Additionally, ethical awareness has a significant effect on the nurse-patient relationship by enhancing trust, respect and compassionate care in line with another survey. This means that nurses who consider their patients' dignity first and foremost, allowing them to take informed decisions autonomously while acting kindly towards them lead to constructive patient experiences and outcomes. There are new and superior techniques for minimally invasive interventions in peripheral artery diseases which include endovascular procedures like balloon angioplasty, drug-eluting stents, balloons, atherectomy and percutaneous transmural arterial bypass. For instance, balloon angioplasty unblocks arteries while drug-eluting gadgets prevent restenosis. In regard to atherectomy, it is used to remove plague built up and PTAB is utilized to bypass blockages without the necessity of surgery. The reasons for this could be due to the use of these techniques which have led to better results for patients with amputations rates decreasing. According to the meta-analyses conducted there is no clear winner between endovascular and open surgical treatments for peripheral vascular disease depending on the lesion site, length or patient's characteristics. Considering all aspects, however, minimal invasiveness yields better results as well as fewer complications [35]. While A case study on Takayasu's arteritis, a systemic large-vessel vasculitis involving the aorta and its branches is reported for a 59-year-old Caucasian woman with TA who underwent revascularization due to cerebrovascular symptoms unresponsive to medical treatment. At first, she was showing signs of amaurosis fugax then while she tapered off corticosteroids, she fainted and had difficulty in pronouncing words. She had occlusions in her right common carotid artery, left internal carotid artery, and left subclavian artery, as well as stenosis of the right vertebral artery and backward flow through the left vertebral artery on vascular studies. In managing this condition successfully, it was done in two stages: restoring posterior circulation by stenting RVA followed by anterior circulation via RCCA bypass from right subclavian resulting into successful management [36].

Current review of the scientific literature shows that surgical procedures for occlusive stenotic vascular diseases in extracranial and lower limb arteries can generally obtain high primary patency rates, reaching 100% at one year with SUPERA stents and procedural success rate of ≥98%. High limb salvage rates remain the primary outcome, while clinically driven revascularization, amputation, and mortality rates are counted among secondary endpoints along with functional improvements. It is reported that acute thrombosis, infection, bleeding, and major adverse events occurred as complications highlighting the need to exercise extreme care during perioperative management. Nevertheless, despite these complications, overall success in terms of patency and limb salvage supports their benefits. Similarly, another study assessed endovascular treatment efficacy in iliac occlusions using 100 patients aged 59.14 ± 8.53 years including 64 males who were treated from January 2013 to November 2017. These patients were classified according to TASC II classification: TASC B occlusions were found in 56% cases; TASC C – in28%; TASC D – in16%. Among cases treated the most common condition was severe claudication (60%). The mean length of an occlusion was equal to 61.41 ±35.15 mm. Complications during surgery occurred at a rate of six percent only. There was significant improvement seen on ankle brachial pressure index after operation being done. Primary patency rates were at one year-98% and five-year-75.1%, without any difference related to complexity of occlusion patterns. The researchers draw a conclusion that endovascular treatment is a safe and effective method for iliac occlusions [37]. Furthermore, covered stent use for endovascular management of persistent sciatic artery aneurysms is also safe and effective. All the cases reviewed, 15 in number, showed favorable outcome with no symptom recurrence, aneurysmal regression or total obliteration. The mean follow-up time was 22 months and low periprocedural complications were reported as compared to high procedural success rate [38]. While another study shows that middle-aged adults can also develop arterial diseases; abdominal aortic, or popliteal artery aneurysms and various stenoses, mostly

asymptomatic until severe complications. Early diagnosis is important in mitigating major adverse cardiovascular and limb events since these arterial diseases are highly correlated with silent coronary artery disease. The study emphasizes the need for risk-directed screening of patients with CAD risk factors and history. Due to scarce resources to perform extensive screenings, complete medical history and physical examination should be carried out. Clinical suspicion may thus be verified by ultrasound so that prompt intervention can be made to prevent grave prognosis [39]. In a similar vein, another research points out that the safe and efficient provision of lower-limb revascularization is an increasingly important medical requirement given the rising global burden of patients with chronic peripheral artery disease. Endovascular procedures for PAD have become a fundamental pillar supporting modern vascular medicine and should be used as first-line revascularization strategy whenever technically feasible and in line with patient preferences. As patients with PAD grow older and their number of comorbidities increases, open vascular surgery is often not possible. As such, the paper puts forward for discussion some key messages on pre-, peri-, and post-procedural management of patients requiring endovascular arterial interventions in the lower limbs which were endorsed by the European Society of Vascular Medicine Board. These key messages focus on interventional vascular physicians who play an increasingly important role in this area [40].

In a current systematic review of surgical techniques for patients with extracranial and lower limb artery stenotic occlusive vascular lesions, all procedures showed significant functional improvement. Notable outcomes were clinical upgrades in the Rutherford classification, higher ankle-brachial index, longer walking distance, better quality of life and symptom amelioration. For instance, rotational atherectomy prior to balloon angioplasty improved significantly ABI while endovascular aneurysm repair produced health utilities like walking capacities. The comparative study between carotid artery stenting and endarterectomy was concerned with stroke incidence as well as quality of life, differing from each other in terms of diverse functional benefits associated with various surgical modalities for vascular diseases. Another study also evaluated short-term outcomes following percutaneous transluminal angioplasty among Rutherford 6 chronic limb threatening ischemia patients from a multi-ethnic Asian population in Singapore. In this work, 48.8% required reintervention within six months while coronary artery disease was a major predictor for that outcome. Mortality rates at three months were 15.1%, at six months were 20.9% and at twelve months were 33.7%; amputation-free survival reached 64.0% after six months and fell to 49.4% by month twelve post treatment. So, managing CLTI is complex and challenging, indicating the need for further studies to optimize treatment approaches [41]. Furthermore, a study, that had access to a big dataset from 2010 to 2020 and compared different endovascular interventions (balloon angioplasty, stenting, atherectomy and atherectomy with stenting) in patients suffering from peripheral artery occlusive disease below the knee. It established that long-term outcomes are better for stenting and atherectomy when used alone or together, including higher patency rates and lower risk of major ipsilateral amputation if compared to balloon angioplasty. Short term results like unplanned amputation rates were similar between treatments thus highlighting the benefit of using stent-grafting and laser-assisted endovascular primary procedures in improving limb salvage without increasing perioperative morbidity. Stenting and atherectomy are superior treatment options than balloon angioplasty only, suggested by these findings [42]. This systematic review points outs different surgical technique for narrowing of arteries in the legs and that occur outside the head, demonstrating substantial functional enhancement such as higher ankle-brachial index, increased distance traveled on foot, and higher quality of life.

LIMITATIONS

This review of surgical results for occlusive arterial disease that arises in extracranial and distal leg arteries reveals several limitations. First, the diversity among studies that are implicated by many factors such as study designs, sample sizes, follow-up rates and outcome measures make it hard to compare them directly and generalise their results. Moreover, a publication bias that leads to preferential acceptance of positive studies can distort the total assessment of efficiency and safety. Also, It could be difficult to come up with uniform conclusions when there is a variation from one period to another in conducting these studies due to changes in surgical techniques and technology over time. Lastly, these studies differ in quality, such as non-blinding or incomplete follow-up of some methodological grounds questions and other findings' strengths. This calls for the standardization of methodologies and the use of rigid study designs if we are to advance our understanding and improve clinical outcomes in vascular surgeries.

RECOMMENDATION

It is necessary to optimize the selection of patients by their ailments and individual patient factors in order to

achieve better surgical results. Thus, it is vital for long-term follow-up studies to confirm how durable outcomes such as patency rates and functional improvements over time are. Comparative effectiveness research should not only consider clinical but also economic implications and patient-reported outcomes that might help guide treatment decisions. This will make evidence more reliable by facilitating stronger comparisons and meta-analyses through standardization of outcome measures and reporting criteria across studies. These recommendations would improve clinical decision-making in relation to the management of stenotic-occlusive vascular lesions in extracranial and lower limb arteries, thereby enhancing patient outcomes.

CONCLUSIONS

Patients have extracranial and peripheral arterial occlusive lesions of stenosis, surgical results showed high efficacy in numerous interventions such as endarterectomy, bypass surgery, angioplasty, and stenting. Studies have consistently demonstrated that there are higher procedural success rates with improved primary outcomes compared to patency and limb salvage rates. However, depending on particular procedures or patient attributes individualized treatment strategies become important. The observed complications are thrombosis, infection, and bleeding that signifies enormous importance for careful perioperative care during which risks should be minimized. The lower extremity interventions are characterized by improved functional status with increased ankle-brachial index, longer walking distances and enhanced quality of life measures. Taken together, these findings underscore that surgical interventions can improve vascular health outcomes; however, it is important to conduct longer term studies to evaluate durability and comparative effectiveness between different modalities.

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