Is the establishment of an orthoplastic service compelling in contemporary practice?

Section 1: Background (<300 words):

Severe open limb injuries require skeletal stabilisation as well as soft tissue cover with special attention to contamination, vascularity and rehabilitation. The traditional sequential care of orthopaedic skeletal fixation first and delayed soft tissue cover, has been found to be associated with delay in healing and higher risk of infection. The orthoplastic care that integrates the services of an orthopaedician and a reconstructive plastic surgeon, in the form of early debridement, stable fixation and timely flap coverage. This approach has been found to be associated with faster healing and less chance of infection.

The available evidence is largely observational, but it is consistent across multiple health systems. Comparative cohort studies show that orthoplastic pathways reduce deep infection, nonunion, number of operations, time to wound healing, time to bone union and return-to-work time. Audit and service studies show that higher-volume centres, dedicated orthoplastic lists, combined senior involvement, daylight operating and direct transfer improve compliance with national standards.

Rajasekaran et al. developed the Ganga Hospital Open Injury Severity Score (GHOISS), which provides an objective framework for injury assessment and has been shown to be useful in guiding salvage decisions. [1] Sabapathy et al. emphasized that successful limb salvage begins with appropriate initial assessment, debridement, and multidisciplinary planning, while Venkatramani and Sabapathy highlighted the evolving role of reconstructive surgery and orthoplastic collaboration in improving outcomes after severe lower limb trauma.[2,3] Recent evidence from developing countries has demonstrated that limb salvage can be associated with acceptable quality of life and economic outcomes when performed within specialized reconstructive services.[4,5]

Despite increasing advocacy for orthoplastic management of severe limb injuries, the evidence supporting the establishment of dedicated orthoplastic services remains fragmented. Most published studies are retrospective cohorts, audits, service evaluations, or registry analyses, with few prospective comparative studies and no randomized controlled trials. Existing literature consistently reports improvements in infection rates, non-union, reoperations, timeliness of soft-tissue coverage, and adherence to treatment standards following orthoplastic implementation. However, substantial heterogeneity exists in patient populations, injury severity, outcome measures, and definitions of orthoplastic care. Furthermore, evidence regarding long-term functional outcomes, patient-reported recovery, quality of life, cost-effectiveness, and applicability in low-resource settings remains limited. While current data strongly support orthoplastic collaboration, the specific components of orthoplastic services that drive improved outcomes and the minimum requirements for establishing such services remain incompletely defined.

Section 2: Data extraction table

For each included study: Author/Year, Study Design, Sample Size, Population, Intervention/Comparator, Key Outcomes, Results, and Follow-up duration.

Example table template (can be edited as per the question)

S.no	Author, year of publication, Country	Study Design	Sample Size (add individually for each group if multiple groups compared)	Study population (Inclusion and exclusion criteria)	Groups compared	Results
1	Trickettet RW et al., 2015, UK		Guidelines era-63 and Standards era-35	All open fractures of the lower limb treated by orthopaedic and plastic-surgical teams. Exclusion: those without complete data available for surgical burden	Patients with open fractures of the lower limb treated in the Guidelines era (October 2006 and December 2009)vs Standards era (January 2011 and December 2011) Follow-up - All surgical interventions within the first 30 days and 12 months after injury were recorded.	• Number of transferred patients approximately **tripled** after introduction of the Standards. • Gustilo IIIB fractures remained the commonest injury: Guidelines era: 88% & Standards era: 49% • Intramedullary nailing (IMN) was the commonest method: 49% (Guidelines) & 63% (Standards) • Monolateral external fixation decreased: 17% → 6% • Primary/direct closure increased markedly: 5% → 26% • Split-thickness skin graft use decreased: 38% → 11% • Significantly fewer surgical procedures were required for DAP and OPP groups compared

						with TP (and TASP) groups in both eras Conclusion: • Early transfer to an orthoplastic centre and treatment by the same orthoplastic team significantly reduced the number of surgical procedures required. • Patients treated entirely within the orthoplastic service had the lowest surgical burden. • The findings support the BOA/BAPRAS Standards and the practice of **urgent transfer before surgery whenever limb-threatening indications (vascular injury, compartment syndrome, gross contamination) are absent.**
2	Fernandez MA et al., 2015, UK	Retrospective observational study	Before OP operating list – 54 and After-51	Management of open lower limb fractures	Patients with open lower limb fractures managed between 1 January 2012 and 14 July 2014 (AFTER) and a retrospective	• Patients with the most severe grades of injury (Gustilo types IIIB and IIIC) increased over the time period studied • Significant reduction in the proportion of injuries undergoing direct • closure was observed (59% vs 37%, p=0.025)

					analysis was conducted of patient records between January 2012 and July 2013 (BEFORE)	• significant rise in the proportion of patients closed with a local flap (12% vs 28%, p=0.040) • Significant reduction in the mean time to definitive soft tissue coverage from 112.8 to 65.4 hours (p=0.019) • Increase in the percentage of patients (from 47.1% to 68.5%, p=0.061) meeting the 72-hour soft tissue coverage target • Of those patients not receiving soft tissue coverage within 72 hours, the percentage subsequently covered within 7 days rose from 48.2% to 83.3% (p=0.017). • Reduction in inpatient stay (25.2 vs 20.3 days) not statistically significant • All these parameters showed similar trends in Gustilo–Anderson grades IIIB and IIIC
3	Lacey et al., 2024, UK	Retrospective analysis	Overall, 133 patients were identified 126 patients had definitive management	All open lower limb fractures managed between August 2020-August 2022	No grouping/ comparison	• Compliance with definitive closure within 72 h was at 75%. • This is comparable or better than the 72-hour outcomes of other MTCs (72% 8 and 21% 16 compliance with 72-hour targets, respectively).

						• The overall average time to definitive in- ternal fixation was 77.4 h.
4.	Boriani F et al.,2017 UK/Pak/Italy	Prospective multi-centre cohort study	154 patients Orthoplastic arm-110 Orthopedic arm-44	All open tibial fractures with severe soft tissue damage-Jan 2012-Dec 2014 Exclusion: Those who were lost to follow-up	Patients treated under Orthoplastic vs orthopedic units Units in the UK and Pakistan followed the Orthoplastic approach while the unit in Italy had an Orthopedic only approach	Orthoplastic arm – more free and local flaps, initial exfix changed to internal fixation. Orthopedic team-more NPWT, healing by secondary intention and direct closures. Infection rates were more in the orthopedic team. The time to soft tissue healing, the duration of inpatient stay, the number of additional operations to bone, the time to radiological bone union and the time to full weight bearing were significantly more favourable in patients undergoing the orthoplastic approach. The orthoplastic approach resulted in a better and faster return of function, which was statistically significant at all timeframes
5	Okuku MD et al., 2025 Uganda	Prospective	48 patients with Gustilo class III tibia fractures	All patients with	No comparison.	

			who presented to the orthopedic centre between June and October 2023	Gustilo class III tibia fractures who presented within 24 h of injury irrespective of the age or fracture location Exclusion: Those who present after having initial debridement or surgery of the fracture at another hospital, traumatic amputations as well as those with significant injury to large vessels that would repair to re-establish perfusion to the distal part of the affected leg. Open Type I, II and IIIC fractures were excluded Paediatric patients were further excluded due	GHOISS sensitivity and specificity in prediciting salvage/amputation	43 were successfully salvaged, while 6 necessitated amputation (4 primary, 2 secondary). A GHOISS of 13 demonstrated maximum specificity (90.7%) and sensitivity (83.3%) in predicting amputation.
6	Trickett RW et al., 2012 UK	Qualitative study using in-depth semi-structured interviews and conventional content analysis	**9 patients** (6 males, 3 females); mean age 44.1 years; mean injury-to-interview interval 2.3 years	Adults >16 years with open tibial fractures treated at Morriston Hospital, discharged from routine follow-up, able to provide informed consent.	No comparison groups	Mena age of injury – 44.1yrs 538 items were identified post treatment, from the interviews.

				Exclusion criteria not explicitly mentioned.		The topics of pain and mobility were central to all of the interviewed patients' descriptions of their recovery.
7	Strong et al., 2020, UK	Retrospective study over a 1 year period	24 patients Feb 2017-Feb 2018	Inclusion: All trauma patients requiring combined orthopaedic and plastic surgery (orthoplastic) care between February 2017 and February 2018. Exclusion: Non-trauma cases such as knee replacement wound dehiscence and chronic osteomyelitis.	No formal comparison groups. Analysis compared estimated actual treatment costs versus hospital tariff payments received	24 patients Median age 57.5 years; Median hospital stay 16 days (range 1–98)Median theatre time 353 min (0.25–14 h). Procedures included 3 free flaps, 3 local flaps, 14 split-thickness skin grafts, and 6 debridement/wound closures. Total payment received: **£304,408**; estimated actual cost: **£425,345**; overall deficit: **£106,345** (average loss £4,431 per admission). Nineteen of 24 admissions generated a financial loss. Even patients receiving TARN Best Practice Tariffs remained loss-making. Authors concluded that current NHS tariff payments do not adequately reimburse orthoplastic trauma care and threaten long-term service sustainability
8	Bano C et al.,2022. UK	Retrospective study	21 consecutive patients with open elbow	Inclusion**:** Consecutive patients presenting with open	Single unipolar elbow fracture (n=14) vs multiple bone fractures	Mean time to first wound debridement - 31 hours

			fractures. All patients received a multidisciplinary orthoplastic approach to their management with consultant plastic surgeon input.	elbow fractures over a 2-year period. Exclusion**:** Not specifically stated	or dislocations (n=7). Additional subgroup analysis by fracture location (distal humerus vs proximal ulna/radial head/dislocation injuries).	14% required flap cover At 2 yr follow-up, 85% had complete bone union. Complications: Zero deep infection; one superficial infection Nearly half the patients (48%) required removal of the metalwork Mean Oxford Elbow Score (OES) was **37.4**, EQ-5D **0.54**, and EQ-VAS **62.18** at final follow-up. No significant differences were found between single-bone and multiple-bone injury groups for OES, EQ-5D, EQ-VAS, complications, or need for further procedures (P > 0.05). Open distal humerus fractures had the highest rates of secondary surgeries
9	Korostelev MY et al., 2022. Russian Federation	Case report describing orthoplastic reconstruction of a severe post-traumatic lower leg defect using Ilizarov transosseous osteosynthesis and a vascularized fibular flap.	One patient-17yrs old male	A 17-year-old patient with Gustilo-Anderson type IIIB open tibial fracture, 7-cm tibial defect, extensive soft tissue loss, chronic osteomyelitis, severe post-traumatic lymphedema, anterior	No group comparison	Staged orthoplastic reconstruction using Ilizarov fixation and a non-free vascularized fibular flap harvested from the contralateral leg. This resulted in weight bearing walking, reduction in lymphedema. Limb salvage was possible

				neurovascular bundle injury, tendon and muscle loss, and compromised lower limb blood supply.		
10	Ylitalo AAJ et al., 2023 Finland	Retrospective cohort study	203 open tibia fractures. Pre-protocol group: 141 patients; Protocol group: 62 patients.	Inclusion: Operatively treated open tibia fractures managed at Tampere University Hospital between 2007 and 2021. Exclusion: Closed fractures, non-tibial fractures, age <15 years, TEN nailing, referral after primary treatment elsewhere, referral out for follow-up, death before definitive treatment, primary amputation.	Compared outcomes before and after implementation of a BOAST 4–based orthoplastic protocol for open tibia fractures. **Pre-protocol group (2007–2016)** vs **Protocol group (2016–2021)**	Definitive fixation and soft tissue coverage was achieved in all (100%) compared to 83% in pre-protocol era.(p=0.0001) Fracture-related infection (FRI) decreased from 20.6% to 1.6% (p=0.0015). Reoperation for non-union decreased from 27.7% to 9.7% (p=0.0054). Secondary amputation rates were similar (2.8% vs 1.6%, p=1.0). Simultaneous definitive fixation and soft tissue coverage increased from 83% to 100%. Multivariable analysis showed that performing fixation and soft tissue coverage in separate operations independently increased the risk of FRI (OR 7.25) and reoperation for non-union (OR 6.96). Authors concluded that implementation of a BOAST 4-based orthoplastic protocol significantly reduced complications.

						The distribution of definitive fixation methods differed significantly between groups (p = 0.0355). Following protocol implementation, the use of plate fixation decreased from 32.6% to 19.4%, while intramedullary nailing increased from 62.4% to 67.7% and definitive external fixation increased from 4.3% to 12.9% The proportion of patients requiring soft tissue reconstruction was similar between groups. Pedicled flap reconstruction was performed in 18.4% of patients before protocol implementation and 14.5% after implementation, while free flap reconstruction increased from 16.3% to 22.6%. These differences were not statistically significant. Primary and secondary amputation rates were low and similar in both groups Interestingly, implementation of the orthoplastic protocol was associated with a modest increase in time to definitive fixation. This likely reflects the logistics of coordinated multidisciplinary planning and simultaneous orthoplastic reconstruction. Nevertheless, infection and nonunion rates decreased

						substantially, suggesting that the quality and coordination of definitive fixation and soft-tissue coverage may be more important than achieving the earliest possible fixation
11	Yang et al., 2024 China	Protocol only-No results				
12	Wilson E et al., 2024. UK	Retrospective registry based study on data from 23 adult Multi Trauma Centres	3359 patients with Gustilo-Anderson IIIB/IIIC open tibial fractures-23 adult MTCs from 2014-2020	**Inclusion:** Adults with GA IIIB or IIIC tibial fractures treated at UK Major Trauma Centres. **Exclusion:** Cases entered by non-MTC hospitals.	No direct treatment groups. Centres were compared according to compliance with six BOAST 4 key performance indicators -KPI (direct MTC admission, orthoplastic plan, antibiotics <3 h, debridement <24 h, definitive fixation <72 h, soft tissue cover <72 h). Age subgroup analysis (<65 vs ≥65 years).	72% admitted directly to MTC 89% had documented orthoplastic plans 54% underwent debridement within 24 h 37% achieved definitive fixation within 72 h 48% achieved soft tissue coverage within 72 h. Early infection requiring return to theatre occurred in 3%, amputation rate was 8.7%, and mortality rate was 2.8%. Higher BOAST KPI scores were significantly associated with lower mortality ($r = -0.54$, $p = 0.014$). Centres achieving higher rates of soft tissue coverage within 72 h had lower amputation rates ($r = -0.423$, $p = 0.044$).

						No significant association was found between infection rates and timing of debridement, fixation, or coverage. Patients ≥65 years had significantly higher amputation (12% vs 7%) and mortality rates (6% vs 2%)
13	Wang Y et al., 2025. China	Retrospective study	746 patients with Gustilo–Anderson IIIB/C open tibial fractures (Orthopedic: 420; Orthoplastic: 326). After matching: 326 vs 326.	Inclusion: Adults >18 years with Gustilo–Anderson IIIB/C open tibial fractures, managed at the institution, follow-up >26 months. Exclusion: Emergency amputees, patients not treated according to institutional protocols, mental illness, CNS disease, unconscious/comatose patients, incomplete follow-up.	Orthopedic approach (staged debridement, prolonged external fixation, delayed soft tissue reconstruction) versus Orthoplastic approach (early antibiotics, aggressive debridement, early fixation, flap coverage, Flap and Open Reduction Internal Fixation and Masquelet (FOM) technique protocol)	Orthoplastic treatment showed significantly lower deep infection (8% vs 29%, P<0.001), superficial infection (8% vs 41%, P<0.001), nonunion (2.5% vs 11%, P<0.001), post-traumatic arthritis (2.1% vs 27%, P<0.001), fewer surgeries (4.6±1.1 vs 10.7±3.3, P<0.001), and shorter wound coverage time (4.0 vs 12.1 days, P<0.001). LEFS functional scores were significantly higher from 3 months onward. Fracture healing time was similar (7.0 vs 7.0 months, P=0.987), and amputation rates were not significantly different (1.2% vs 3.1%, P=0.11). Multivariate analysis found out risk factors for non-union (smoking and non use of antibiotic bone cement) and deep infection (smoking and non use of antibiotics).

14	Toia F et al.,2019. Palermo	Retrospective comparative cohort study	35 patients total: Orthoplastic (2015-2017) group n=16; Orthopedic group n=19 (2013-2014)	**Inclusion:** Patients with Gustilo IIIB/IIIC open tibial fractures or tibial septic pseudarthrosis treated between 2013–2017 with minimum 12 months follow-up. **Exclusion:** Not specifically stated	**Orthoplastic approach** (joint orthopedic-plastic management, external fixation + microsurgical free flap reconstruction) versus **Orthopedic-based approach** (orthopedic management alone, dressings/VAC/dermal substitutes, delayed plastic surgery referral when required) Orthoplastic (2015-2017) group n=16; Orthopedic group n=19 (2013-2014)	Orthoplastic treatment significantly improved outcomes. Mean soft tissue healing time decreased from 30 to 4 weeks, bone union time from 18 to 10 months, reintervention rate from 53% to 19%, deep infection rate from 50% to 17%, and return to work from 20 to 13 months. Hospital stay (55 vs 42 days) and need for special shoes (32% vs 25%) were not significantly different. All free flaps survived in the orthoplastic group.
15	Al-Hourani K et al., 2019. UK	Consecutive cohort study using prospectively collected data from a Level 1 trauma centre.	113 patients with Gustilo IIIB open tibial shaft fractures. ORDB (Orthoplastic Reconstruction using mechanically relevant Devitalized Bone) group: 44; Non-ORDB group: 69.	Inclusion: Gustilo IIIB open diaphyseal tibial fractures managed between 2014–2018. Exclusion: IIIA and IIIC fractures, ankle fractures, metaphyseal tibial fractures, primary amputations, primary bone transport procedures, periprosthetic fractures, early mortality, loss to follow-up, and	Orthoplastic reconstruction using mechanically relevant devitalized bone (ORDB) retained during reconstruction versus standard orthoplastic reconstruction without retained devitalized bone (non-ORDB). Both groups underwent orthoplastic management	Deep infection occurred in 2.3% (1/44) of ORDB patients versus 10.1% (7/69) of non-ORDB patients (p=0.119). Overall infection rate was 7.1%. Reoperation rate was 6.6% overall, with only 2 of 16 reoperations occurring in the ORDB group. Nonunion occurred in 2.3% vs 7.2%, infection-associated flap failure in 0% vs 5.8%, and overall complications in 6.8% vs 11.6% (all non-significant).

				patients unsuitable for the standard two-stage protocol		Diabetes was the only significant predictor of infection (OR 20.4, p=0.006) and complications (OR 84.2, p=0.002). Authors concluded that retaining mechanically relevant devitalized bone fragments during orthoplastic reconstruction did not increase infection or complication rates.
16	Rymer B et al.,2017 UK	Retrospective two-centre audit assessing compliance with BOAST 4 standards in orthoplastic centres.	84 patients with open lower limb fractures, from two UK centres	Inclusion**:** Patients admitted to Royal Stoke University Hospital and Norfolk & Norwich University Hospital orthoplastic centres with open lower limb fractures between 2009 and 2014. Exclusion**:** Missing or inadequate data.	No comparison	Initial debridement within 24 h was achieved in **98.8%** of patients. However, **55.3%** of operations were performed out of hours, and only **23.8%** of these had a clear indication for urgent surgery. Plastic surgeons were present at only **33.3%** of initial debridements. Definitive fixation and soft tissue coverage were achieved within **72 h in 56.4%** and within **7 days in 78.2%**. Appropriate antibiotics on admission: **92.4%** Mean time to coverage was **6.6 days** Mean hospital stay **19.2 days**, and mean number of operations **2.7 per patient**. Delays were mainly attributed to inter-hospital transfer, lack of plastic surgeon

						involvement at initial surgery, and critical illness
17	Yarrow J et al., 2015. UK	Prospective audit-multicentre-orthoplastic services in South West England and Wales.	86 patients-open tibial diaphyseal fractures managed across 6 orthoplastic centres over 6 months.	Inclusion**:** All open tibial diaphyseal fractures admitted to six regional orthoplastic centres between October 2012 and March 2013. Exclusion**:** Open intra-articular tibial fractures (plateau, pilon, malleolar fractures).	No comparison	56% presented directly to orthoplastic centres and all transferred patients reached specialist centres within 24 hours. Correct antibiotic administration occurred in 88% at admission, 50% at primary surgery, and 62% at definitive surgery. Debridement within 24 hours: **100%** Definitive fixation and coverage within 7 days: **81%** Combined senior orthoplastic teams at primary surgery: **60%** Compliance improved in centres with higher caseloads and when senior orthoplastic teams were involved early A plastic surgeron with vascular reconstruction expertise was almost always present. Dedicated combined theatre was never or sometimes available
18	Gopal et al., 2000. UK	Retrospective study	80 patients, 84 fractures	Consecutive patients with severe open tibial fractures	Early orthoplastic management with radical debridement,	Limb salvage rate 95% (76/80 patients).

				(Gustilo IIIB/IIIC) following blunt trauma. Excluded: 1 unrelated death and 3 lost to follow-up. Mean age 37 years (3–89 years)	skeletal stabilisation and vascularised muscle flap coverage. Early coverage (<72 h) versus delayed coverage (>72 h). Follow-up to union or 1 year.	Four amputations. Primary bony union in 51 fractures (66%); 26 fractures (34%) required secondary bone-stimulating procedures. Flap failure rate 3.5%. Superficial infection 6%; deep infection 9.5%. Delayed soft-tissue cover (>72 h) was associated with most complications. External fixation was associated with chronic pin-track infection (37%) and malunion. Authors concluded that coordinated orthopaedic-plastic surgery management with early flap coverage achieved excellent outcomes and recommended referral to specialist orthoplastic centres.
19	Berner JE et al., 2022, International (16 countries)	Multicentre international retrospective audit	2694 patients from 62 centres in 16 countries	Patients with open lower extremity fractures treated between 1 Jan 2017 and 31 Dec 2018.	High-income countries with national guidelines vs high-income countries without guidelines vs low-/middle-income countries; multidisciplinary orthoplastic care vs non-multidisciplinary care.	Overall wound infection 16.3%, deep infection 10.3%, non-union 10.9%, and amputation 5.8% (immediate 2.1%, early 2.7%, late 1%). Delay in soft-tissue closure beyond 72 h significantly increased soft-tissue infection, deep infection, non-union and amputation.

						Joint orthopaedic-plastic surgeon involvement from initial debridement reduced secondary amputation risk (OR 0.41, p=0.008). Treatment in countries with established national guidelines reduced deep infection (OR 0.66, p=0.040) and non-union (OR 0.66, p=0.043). High-income countries with guidelines achieved earlier soft-tissue cover (4 vs 12 vs 8 days) and more multidisciplinary debridement (24.4% vs 7.0% vs 6.9%). Authors concluded that multidisciplinary orthoplastic management and adherence to guidelines improve outcomes after open lower limb fractures. Median follow-up: 11 months
20	Rajasekaran et al., 2006, India	Prospective validation study of Ganga Hospital Open Injury Severity Score	**109 open tibial injuries**: 42 Gustilo IIIA, 67 Gustilo IIIB	Consecutive Gustilo IIIA/IIIB open tibial fractures	GHOISS compared with MESS for predicting salvage/amputation	GHOISS threshold **14** predicted amputation with sensitivity **98%**, specificity **100%**, PPV **100%**, NPV **70%**. It predicted flap requirement, time to union, number of procedures, inpatient stay, and deep infection.
21	Rajasekaran & Sabapathy, 2007, India	Review/philosophy of care paper	Not applicable	Severe open limb injuries managed using Ganga Hospital philosophy	No comparison	Described an integrated orthoplastic model with joint assessment by orthopaedic, plastic and anaesthesia teams from arrival, debridement,

						reconstruction and follow-up. Proposed protocols: Fix and Close, Fix, Bone Graft and Close, Fix and Flap, and Stabilise, Watch, Assess and Reconstruct.
22	Sethuraman et al., 2021, India	Prospective cohort or cost and quality of life assessment	**78 patients**: salvage 42, BKA 16, AKA 20	Adult severe open tibial fractures with **GHOISS >13**	Limb salvage vs below knee amputation vs above knee amputation	Salvage had better function: LEFS **51** vs BKA **39** vs AKA **31**. SF-12 PCS: **48** vs 40 vs 34. Salvage cost more initially but had better return-to-work likelihood at 36 months.
23	Sabapathy et al., 2019, India	Narrative review / expert guidance	Not applicable	Severely injured lower extremity	No comparison	Discusses principles of initial assessment, radical debridement, decision-making for salvage versus amputation, skeletal stabilization, and early soft tissue reconstruction within an orthoplastic framework.
24	Venkatramani & Sabapathy, 2019, India	Editorial / perspective article	Not applicable	Lower limb reconstruction practice	No comparison	Highlights the evolving role of reconstructive microsurgery and orthoplastic collaboration in lower limb trauma care. emphasizing systems, training, and future directions.

Section 3: Results summary write-up (upto 500 words)

Twenty four studies published between 2000 and 2025 were included. The evidence consisted predominantly of retrospective cohort and comparative observational studies, supplemented by prospective cohorts, service audits, registry analyses, an international multicentre audit, a qualitative study, an economic evaluation, and one study protocol. The studies originated from the United Kingdom, Italy, Finland, China, Russia, Uganda, and 16 countries

participating in the INTELLECT collaboration.[1-24] Most evaluated Gustilo–Anderson IIIB and IIIC open tibial fractures and collectively represented over 10,000 patients.

Timeliness of Care

Improved timeliness of treatment was a consistent finding. Gopal et al. achieved flap coverage within 72 hours in 75% of severe open tibial fractures and reported increased complications when coverage was delayed.[6] Fernandez et al. demonstrated a reduction in mean time to soft tissue coverage from 112.8 to 65.4 hours following introduction of a dedicated orthoplastic operating list. [7] Yarrow et al. reported definitive fixation and coverage within 7 days in 81% of patients, increasing to 91% with early senior orthoplastic involvement. [8] INTELLECT similarly demonstrated shorter treatment timelines in systems supported by multidisciplinary care and national guidelines. [9]

Infection Outcomes

Orthoplastic care was consistently associated with lower infection rates. Wang et al. reported lower deep infection (8% vs 29%) and superficial infection (8% vs 41%) compared with conventional orthopedic management.[10] Toia et al. demonstrated a reduction in deep infection from 50% to 17%, while Ylitalo et al. reported a decrease in fracture-related infection from 20.6% to 1.6% after protocol implementation. [11,12] INTELLECT found a 34% reduction in deep infection risk in healthcare systems supported by national guidelines.[9]

Bone Healing and Nonunion

Improved bone healing was observed across comparative studies. Wang et al. reported lower nonunion rates (2.5% vs 11%) and fewer procedures per patient (4.6 vs 10.7) with orthoplastic care. [10]Toia et al. demonstrated a reduction in time to union from 18 to 10 months and fewer reinterventions (53% vs 19%).[11] Ylitalo et al. reported reduced surgery for nonunion following protocol implementation, while INTELLECT demonstrated lower nonunion rates in guideline-based systems.[11,9]

Limb Salvage and Amputation

Limb salvage rates were high. Gopal et al. achieved 95% limb salvage, including all Gustilo IIIC injuries. INTELLECT demonstrated that combined orthopaedic-plastic surgical management from debridement onwards reduced the risk of secondary amputation by 59% (OR 0.41). [9] Wilson et al. similarly reported lower amputation rates in centres achieving earlier soft tissue coverage.[13]

Functional Outcomes

Functional outcomes generally favoured orthoplastic management. Wang et al. demonstrated superior Lower Extremity Functional Scale scores throughout follow-up, while Toia et al. reported earlier return to work (13 vs 20 months).[10,11] Trickett et al. highlighted the importance of mobility, pain, employment, social participation, appearance, and psychological adaptation in recovery after severe lower limb trauma.[14]

Service Delivery and Compliance

Service audits demonstrated improved compliance when care was delivered through dedicated orthoplastic pathways. Early orthoplastic involvement improved achievement of timing targets, antibiotic administration, and definitive reconstruction. Wilson et al. reported lower mortality and amputation rates in centres with greater adherence to BOAST standards, although variation in access to specialist services persisted.[13]

Economic Outcomes

Strong et al. demonstrated that orthoplastic trauma care is resource intensive and generated an annual service deficit exceeding £100,000. [17] However, reductions in infection, nonunion, reoperations, and prolonged treatment suggest potential long-term economic benefits through avoidance of costly complications and disability.

Section 4: Discussion (<1000 words)

Management of open fractures has undergone significant transformation in the past two decades. Traditionally the orthopaedic and Plastic surgical interventions were performed sequentially. However extensive studies showed that a combined Orthoplastic approach in managing the severe open limb injuries resulted in improved limb salvage rate and low infection rates. his evolution has been reflected in the development of national standards such as the British Orthopaedic Association Standards for Trauma (BOAST), which advocate early multidisciplinary assessment, prompt debridement, definitive skeletal stabilization, and timely soft tissue reconstruction within dedicated orthoplastic services.[7,8,12,13,15,16,18,24] Fix and Flap study by Gopal et al., demonstrated excellent outcomes with this approach.[6] Subsequent studies from the United Kingdom, Europe, Asia, and international collaborative networks have consistently reinforced these principles, transforming orthoplastic care from a surgical technique into a comprehensive service model.

The most compelling evidence to support the Orthoplastic approach is related to improved clinical outcomes. Multiple comparative studies showed lower rates of infection, non-union and reoperation with orthoplastic care. Wang et al. demonstrated significantly lower rates of deep infection, superficial infection, and nonunion in patients managed through an orthoplastic pathway compared with conventional orthopedic care.[10] Similarly, Toia et al. reported reductions in infection, reintervention, and time to union after establishment of an orthoplastic service. [11]Ylitalo et al. showed substantial improvements following implementation of a BOAST-based orthoplastic protocol, with marked reductions in fracture-related infection and surgery for non-union. [12] These findings were further supported by the international INTELLECT study, which demonstrated reduced rates of deep infection and non-union in healthcare systems supported by multidisciplinary orthoplastic care and national treatment guidelines.[9] Collectively, the evidence suggests that orthoplastic services not only improve process measures but also translate these improvements into meaningful clinical benefits.

Timely soft tissue coverage is one of the most consistently observed findings across literature. Gopal et al. identified delays beyond 72 hours as a major contributor to complications, while Fernandez et al. demonstrated that dedicated orthoplastic operating lists significantly reduced delays to definitive coverage. [6,7] Similar observations were reported in Yarrow et al., Wilson et al., and the INTELLECT study. [8,9,13] Early soft tissue coverage reduces bacterial contamination, protects exposed bone and implants, improves vascularity, and creates an environment conducive to fracture healing. Importantly, these studies suggest that successful early coverage is often a marker of a well-functioning orthoplastic service rather than an isolated surgical achievement. The ability to consistently achieve timely reconstruction requires coordinated multidisciplinary planning, theatre access, and availability of reconstructive expertise.

The greatest improvements were observed in centres with dedicated pathways, multidisciplinary collaboration, and early combined decision-making. Service audits consistently demonstrated better compliance with treatment standards when orthopaedic and plastic surgeons were involved together from the initial stages of care. The INTELLECT study further demonstrated lower amputation rates when plastic surgeons participated from the time of debridement. [9] These findings indicate that successful orthoplastic care depends not only on surgical expertise but also on organisational structures that facilitate timely and coordinated management.

A few studies measured patient outcomes that reflected patient recovery. Studies reporting functional outcomes consistently favoured orthoplastic management, with improvements in mobility, return to work, and overall function. Wang et al. reported superior Lower Extremity Functional Scale scores following orthoplastic treatment, while Toia et al. demonstrated earlier return to employment.[10,11] The qualitative study by Trickett et al. highlighted that patients define recovery in broader terms, including pain control, social participation, self-image, independence, and psychological adaptation. [14] These findings emphasize that the ultimate goal of orthoplastic care extends beyond limb preservation to restoration of meaningful function and quality of life.

Audits by Yarrow J et al., Rymer B et al., Lacey et al., and Wilson E et al., revealed that centres with dedicated orthoplastic pathways achieved better compliance with national standards, earlier reconstruction, and improved outcomes. [8,13,15,16] Conversely, delays in transfer, lack of plastic surgical

involvement, and limited access to specialist services were associated with poorer compliance. These findings support the concept that orthoplastic care should be viewed as a system-level intervention requiring dedicated infrastructure, referral pathways, and multidisciplinary collaboration.

Strong et al. demonstrated that orthoplastic trauma care is resource intensive and may be inadequately reimbursed under current funding models.[17] However, the apparent financial burden must be interpreted alongside the substantial reductions in infection, nonunion, repeated surgery, prolonged hospitalization, and disability observed across the literature. While direct cost-effectiveness data remain limited, prevention of major complications is likely to result in long term economic savings for both healthcare systems and society. Experience from India has demonstrated that successful limb salvage can be achieved in resource-constrained settings through careful patient selection, structured injury assessment, and coordinated reconstructive care.[4,5] The Ganga Hospital Open Injury Severity Score provides a reproducible framework for evaluating injury severity and guiding salvage decisions, while studies from specialized centres have demonstrated favourable functional and quality-of-life outcomes following limb salvage.[1-5]

The current evidence has limitations. Most of the studies are retrospective observational research. Randomised controlled trials are lacking. Considerable heterogeneity exists in injury severity, outcome definitions, and models of orthoplastic care. Functional, patient-reported, and economic outcomes remain underreported. Future research should focus on prospective multicentre studies, standardized outcome reporting, cost-effectiveness analyses, and identification of the service components required to deliver effective orthoplastic care.

Section 5: Risk of bias of included studies

LOW/ MODERATE/ HIGH

MODERATE

The overall risk of bias was judged to be **moderate**. Most included studies were retrospective cohort studies, audits, registry analyses, service evaluations, or case reports, with no randomized controlled trials

Section 6: Response/Recommendation (1-2 lines as a conclusion and recommendation statement for the question)

The establishment of an orthoplastic service is compelling in contemporary practice for open lower limb trauma, particularly Gustilo–Anderson IIIB and IIIC tibial fractures. Dedicated orthoplastic pathways should be recommended wherever feasible, with early combined orthopaedic-plastic surgical decision-making, timely debridement, stable fixation, and definitive soft tissue coverage.

Section 7: Level/ strength of Evidence:

LOW/ MODERATE/ HIGH with justification.

Based on the number of studies, risk of bias, study design, sample size, and key outcomes.

The strength of evidence is judged to be **moderate**. Although the evidence base lacks randomized controlled trials and is dominated by observational studies, the consistency, magnitude, and direction of effect across 19 studies support the recommendation. Orthoplastic care was consistently associated with improved timeliness of care, reduced infection, reduced nonunion, fewer reoperations, improved limb salvage support, better compliance with national standards, and improved functional recovery [1,4,6,10,13,14,18,19].

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