Is the Gustilo-Anderson classification system still a valid tool for classifying open injuries?

Section 1: Background:

The Gustilo-Anderson classification is the most established system for describing open fractures and remains widely used because it is simple, familiar, and linked to initial management pathways. It was developed to stratify open long-bone injuries by wound size, contamination, soft-tissue damage, fracture severity and, later, vascular injury and soft-tissue coverage requirements [1,2]. The central question is whether it remains valid in contemporary practice, where validity requires not only clinical familiarity, but also reproducibility, prognostic value, and applicability across anatomical regions, paediatric injuries, gunshot wounds, low-resource settings and modern orthoplastic reconstruction.

The evidence base shows that Gustilo-Anderson still has prognostic value for broad infection, union and amputation risk stratification, particularly in tibial and long-bone open fractures [2,19,24]. However, major limitations are consistent: interobserver agreement is only moderate or poor in several studies [4,5,11], the system has limited granularity for contamination, muscle injury and bone loss [6,18], and it performs less well in special anatomical or contextual settings such as paediatric fractures, hand injuries, gunshot injuries and low-income settings [3,8,14,20,23]. Newer systems such as OTA-OFC, OTS and GHOISS add domain-specific or context-specific information, but have not fully replaced Gustilo-Anderson because of complexity, inconsistent superiority and limited routine uptake [6,7,9,10,15,16,21,22,25].

Section 2: Data extraction table

Author, year of publication, Country	Study Design	Sample Size	Study population (Inclusion and exclusion criteria)	Groups compared	Results	Conclusion
Gustilo & Anderson, 1976, USA	**Retrospective and prospective clinical series** introducing the original Gustilo-Anderson open-fracture classification and antibiotic/debridement protocol.	**1,025 open fractures of long bones**; included a prospective cohort with wound cultures.	Open long-bone fractures treated at a trauma centre. Original system focused mainly on **open tibial/long-bone injuries**; classification based on wound size, contamination, soft-tissue injury and fracture severity.	**Type I vs Type II vs Type III** open fractures; infection outcomes before/after a standardized protocol.	Prospective study infection rate **2.5%**. Type III infection rates fell from **44%** in the retrospective series to **9%** in the prospective protocol series. Type III injuries were defined by severe soft-tissue injury, segmental fracture or traumatic amputation.	Established the original simple open-fracture framework and linked increasing injury grade to infection risk. Still foundational, but derived from historical care and less granular than modern systems.
Gustilo, Mendoza & Williams, 1984, USA	**Retrospective clinical series** and classification refinement paper for severe Type III open fractures.	**87 Type III open fractures in 75 patients**; mean follow-up **26 months**.	Patients with severe Type III open fractures, especially injuries with extensive contamination, soft-tissue damage, periosteal stripping and/or vascular injury.	**IIIA vs IIIB vs IIIC** subtypes; severe open-fracture subtypes linked to soft-tissue coverage, periosteal stripping and vascular repair.	Wound sepsis: **IIIA 4%**, **IIIB 52%**, **IIIC 42%**. Amputation rates: **IIIA 0%**, **IIIB 16%**, **IIIC 42%**. Demonstrated that the original Type III group was too broad.	The IIIA/IIIB/IIIC subdivision created the modern structure of the Gustilo-Anderson system and remains prognostically meaningful for severe open fractures.
McLain et al., 1991, USA	**Retrospective cohort study** applying open-fracture classification to hand injuries.	**146 consecutive open hand fractures**.	Patients with open fractures of the hand. Included hand injuries across severity groups; focus on infection and functional outcomes.	**Gustilo-Anderson type I vs II vs III** open hand fractures; infection, length of stay, return to work and functional outcome.	Overall infection rate **11%**. Infection by Gustilo type: **Type I 0%**, **Type II 9%**, **Type III 14%**. Gross contamination infection rate **20.5%**. Gustilo type correlated with infection, hospital stay, return to work and function.	Shows Gustilo-Anderson has some prognostic value beyond the tibia, but hand-specific factors such as contamination, tendon/nerve involvement and tissue coverage are not fully captured.
Horn & Rettig, 1993, USA	**Interobserver reliability study** using photographic slides before and after operative treatment.	**10 open-fracture cases** assessed by a group of orthopaedic surgeons.	Patients with open fractures photographed pre- and post-operatively. Surgeons were given clinical information and asked to assign Gustilo-Anderson grade.	Observer agreement for **Gustilo-Anderson classification**.	Kappa analysis showed only **moderate agreement** of around **0.53**. Reliability was limited despite explanation of the system and clinical information.	Important early evidence that Gustilo-Anderson is familiar but observer-dependent; validity is constrained by reproducibility.
Brumback & Jones, 1994, USA	**Survey-based interobserver agreement study** using videotaped open tibial fracture cases.	**245 orthopaedic surgeons**; **12 videotaped open tibial fractures** used for classification analysis.	Orthopaedic surgeons at trauma/orthopaedic meetings classified selected open tibial fracture presentations. Included residents/fellows and experienced trauma surgeons.	Agreement in assigning **Gustilo-Anderson type**; subgroup comparison by experience.	Average agreement for all 12 fractures **60%**; range **42% to 94%**. Least-experienced subgroup agreement **59%**; most-experienced trauma surgeons **66%**. Agreement remained case-dependent.	Gustilo-Anderson interobserver agreement was moderate-to-poor; classification alone may be inadequate for treatment decisions or comparison of published results.
Orthopaedic Trauma Association: Open Fracture Study Group, 2010, USA	**Consensus/development study** proposing the OTA Open Fracture Classification (OTA-OFC).	**34 candidate factors** identified by literature review and expert ranking; prospective clinical application to consecutive open fractures.	Open fractures across anatomical regions, intended to address the limited granularity of Gustilo-Anderson. Not an outcome-validation cohort.	Candidate variables and final OTA-OFC domains: **Skin, Muscle, Arterial injury, Contamination, Bone loss**.	Consensus selected **5 essential domains**. Prospective use showed the domains were broadly applicable, but subcategories needed refinement. Skin injury was better assessed by approximation potential than wound length; contamination and bone loss required separate scoring.	OTA-OFC was designed to supplement/overcome Gustilo-Anderson limitations. It is more comprehensive but originally required further validation.
Agel et al., 2013, USA / multicentre international raters	**Video-based reliability study** of the OTA-OFC.	Orthopaedic surgeons and residents rated open-fracture videos; exact rater/case set varied by meeting/grand-rounds setting.	Practicing orthopaedic surgeons and residents classified open fractures of upper and lower extremities using OTA-OFC.	Reliability of OTA-OFC domains; comparison with published Gustilo-Anderson reliability literature.	Arterial injury had **near-perfect agreement**. Skin injury, bone loss and contamination showed **moderate-to-substantial agreement**. Muscle injury had the most disagreement but still exceeded published Gustilo-Anderson reliability in several comparisons.	OTA-OFC is more reliable than Gustilo-Anderson in some domains and provides greater tissue-specific detail, supporting the view that Gustilo alone is incomplete.
Kanz & Carmichael, 2014, USA	**Measurement-based classification modification proposal** for paediatric open fractures.	**100 adult volunteers**; limb segment measurements used to derive a paediatric scaling rule.	Adult limb segment lengths and circumferences measured to translate Gustilo adult wound-size thresholds to children. No clinical outcome cohort.	Adult Gustilo-Anderson wound-size threshold vs paediatric limb-size-adjusted threshold.	Found that **30% of a paediatric limb segment** approximates a **10 cm adult wound threshold** for distinguishing Type II from Type III injuries.	Absolute wound-size thresholds in Gustilo-Anderson may underestimate severity in children. Paediatric use requires size-adjustment or caution.
Agel et al., 2014, USA	**Retrospective chart review of prospectively collected OTA-OFC data**; prognostic study.	**356 patients** with open fractures at a Level I trauma centre.	Open fractures of femur, tibia, malleoli, humerus, radius/ulna, pelvis, acetabulum, foot and clavicle. OTA-OFC recorded during routine care.	OTA-OFC domains vs early amputation and treatments: VAC, >=3 debridements, antibiotic beads.	OTA-OFC was associated with treatment burden. Early amputation predictors included **skin injury**, **contamination** and **arterial injury**. In lower leg, skin injury OR **4.0** and arterial injury OR **3.4** were associated with early amputation.	OTA-OFC domains capture clinically important information not represented by a single Gustilo grade; useful for treatment/outcome stratification.
Hao et al., 2016, USA	**Retrospective observational cohort study** at a Level I trauma centre.	**512 adult patients** with open long-bone fractures; **19 amputations (3.7%)**.	Adults >=18 years with open long-bone fractures treated operatively from 2007-2012; minimum follow-up >=3 months. Excluded outside initial treatment or insufficient records.	**OTA-OFC vs Gustilo-Anderson** for amputation, infection and soft-tissue coverage.	Gustilo-Anderson showed **no correlation** with primary outcomes. OTA-OFC summative scores differed significantly; skin injury predicted amputation: OR **5.44** (95% CI **2.37-12.47**). OTA-OFC score **>=10** predicted amputation with sensitivity **79%** and specificity **94%**.	OTA-OFC outperformed Gustilo-Anderson for outcome prediction in this cohort, suggesting Gustilo alone is not adequate for modern prognostication.
Ghoshal et al., 2018, Australia	**Interobserver reliability comparison study**.	**91 open long-bone fractures** assessed by **8 surgeons**.	Patients of any age with first presentation of open long-bone fracture; radiographs, wound photographs and short clinical descriptions provided to raters.	**Gustilo-Anderson vs OTA-OFC** interobserver reliability.	Overall interobserver agreement: Gustilo-Anderson kappa **0.44**; OTA-OFC kappa **0.49**. OTA-OFC provided more detailed description but only modestly improved reliability.	OTA-OFC is more detailed but reliability remains moderate. Gustilo-Anderson is not uniquely unreliable; classification systems remain observer-dependent.
Oliveira, Cruz & Matos, 2018, Brazil	**Comparative accuracy study** of open-fracture classification systems as infection predictors.	Clinical cohort of open fractures; sample details varied by source reporting.	Open fractures classified by Gustilo and Tscherne systems, with infection as the outcome of interest.	**Gustilo vs Tscherne** classification as predictors of infection.	Tscherne classification showed better accuracy, particularly specificity, as a predictor of infection compared with Gustilo classification.	Gustilo-Anderson has infection-stratification value, but other soft-tissue classification approaches may be more accurate in some cohorts.

Author, year of publication, Country	Study Design	Sample Size	Study population (Inclusion and exclusion criteria)	Groups compared	Results	Conclusion
Agrawal et al., 2018, India	**Development and reliability/acceptability study** of a unified classification based on Gustilo and OTA.	**5 fractures** assessed by **15 surgeons**.	Open fractures classified using Gustilo, OTA-OFC and a new unified system.	**Gustilo vs OTA-OFC vs unified classification**.	Unified classification showed excellent interobserver reliability: alpha **0.93**. More surgeons preferred the unified classification than Gustilo or OTA-OFC.	Attempts to merge Gustilo simplicity with OTA-OFC detail may improve reliability and acceptability; this supports modification rather than abandonment of Gustilo concepts.
Warrender et al., 2019, USA	**Interobserver reliability study** using open hand fracture cases.	**16 fellowship-trained hand surgeons**; **10 open hand fracture cases**.	Open hand fracture radiographs and wound photographs. Surgeons classified each case using Gustilo-Anderson and Tulipan-Ilyas systems.	**Gustilo-Anderson vs Tulipan-Ilyas** classification for open hand fractures.	Overall kappa: Gustilo-Anderson **0.339** (fair) vs Tulipan-Ilyas **0.443** (moderate). Single-measure ICC: Gustilo-Anderson **0.595** vs Tulipan-Ilyas **0.958**.	A hand-specific system was more reliable than Gustilo-Anderson; Gustilo is not sufficiently anatomical-region-specific for hand injuries.
Trompeter et al., 2020, UK	**Classification development and outcome-correlation study** using large UK trial datasets.	**748 participants** with open lower-limb fractures; simple **288 (38.5%)**, complex **460 (61.5%)**.	Adults with open lower-limb fractures recruited in UK Major Trauma Network trials; outcomes collected over 12 months.	**Orthopaedic Trauma Society (OTS) classification** simple vs complex; subgroups based on reconstruction/vascular repair.	At **12 months**, mean Disability Rating Index: simple **32.5** vs complex **43.9**; difference/OR reported **8.19** (95% CI **3.69-12.69**). OTS correlated with patient-reported disability and quality of life; not strongly with 30-day deep SSI.	Objective reconstructive descriptors can predict patient-centred outcomes. Gustilo-Anderson remains useful but less directly tied to modern reconstruction burden.
Garner et al., 2022, USA	**Retrospective review** from **2 Level I trauma centres**.	**501 consecutive open tibial shaft fractures**; **419** had 90-day follow-up.	Open tibial shaft fractures over 5 years. Outcomes included definitive closure, 90-day wound complication, reoperation, nonunion and amputation.	OTA-OFC domains vs closure type, wound complication, nonunion and amputation.	Primary closure **57.3%**; local flap **9.6%**; free flap **22.8%**; amputation **8.6%**. OTA-OFC skin correlated strongest with closure type (**r=0.81**). OTA-OFC muscle predicted nonunion OR **2.2** and amputation OR **9.3**; arterial predicted amputation OR **4.8**.	OTA-OFC captures reconstructive and prognostic detail beyond Gustilo-Anderson, especially muscle and arterial injury.
Axelrod et al./FLOW Investigators, 2023, International multicentre	**Secondary analysis of a multicentre prospective randomized controlled trial**.	**2,420 participants** from the FLOW trial.	Open fractures enrolled in FLOW. Preoperative and definitive Gustilo-Anderson classifications compared; outcome was surgical site infection.	Initial vs definitive Gustilo-Anderson grade; misclassified vs unchanged grade.	Gustilo-Anderson grade changed in **305/2,420 (12.6%)**. Factors associated with upgrading included non-tibial fracture site, bone loss, wound width/length and skin loss. Misclassification of Type III as Type II was **not associated with increased SSI** (P=**0.14**).	Gustilo-Anderson is often changed after operative assessment, but initial misclassification did not increase SSI in this dataset. Definitive grading remains more accurate after debridement.
Kovvur et al., 2024, USA	**Retrospective case series / diagnostic alignment study**.	**2,027 patients** with **2,215 open fractures**.	Adults >=18 years with operatively treated open extremity fracture and surgeon-assigned OTA-OFC and Gustilo-Anderson grades from 2010-2021.	Distribution/alignment of OTA-OFC domains across Gustilo-Anderson grades.	GA I/II **961 fractures (43%)**; IIIA **978 (44%)**; IIIB **204 (9%)**; IIIC **72 (3%)**. OTA-OFC contamination had weak association with Gustilo severity: beta **0.05** (95% CI **0.01-0.09**). Arterial beta **0.50** and skin beta **0.46** aligned more strongly.	Gustilo-Anderson does not adequately capture contamination, a known infection predictor; OTA-OFC adds clinically relevant detail.
Khoury et al., 2024, USA	**Retrospective cohort study** using prospectively collected institutional data.	**890 patients** with **912 open tibia fractures**; **142 infections (16%)**.	Patients aged >=16 years with operatively treated open tibia fractures (OTA-AO 41, 42, 43); excluded incomplete OTA-OFC or <3 months follow-up.	**OTA-OFC vs Gustilo-Anderson** for fracture-related infection (FRI).	OTA-OFC was **not better** than Gustilo-Anderson for FRI: AUC **0.66 vs 0.66**, P=**0.89**. Gustilo-Anderson explained **72%** of FRI variance; adding OTA-OFC contamination improved explained variance to **84%** (P=**0.04**). Embedded contamination increased FRI risk by **~10%** across grades.	Gustilo-Anderson remains a useful FRI predictor in open tibia fractures, but adding contamination improves prognostic ability.
Lunga et al., 2024, South Africa	**Retrospective reclassification study** from a prospectively collected cohort.	**137 open tibia/femur fractures** treated with intramedullary nailing.	Adults >=18 years with open tibia and femur fractures, high prevalence of civilian gunshot wounds; excluded closed fractures, non-viable limbs, >48 h to first debridement or unable to follow-up 12 months.	Gustilo-Anderson classification vs Orthopaedic Trauma Society (OTS) reclassification.	Mean age **34 years**; **90% male**; low-velocity civilian gunshot wounds **54.7%**. Primary closure **23.4%**, soft-tissue reconstruction **24.1%**, secondary intention **52.6%**. OTS classification possible in only **47.5%**.	OTS did not encompass many gunshot-related wounds; open-fracture classifications require contextual modification. Gustilo also remains limited in high-GSW settings.
Adejuyigbe et al., 2025, USA / OTA Committee	**Systematic review** of OTA-OFC use since 2010.	Included English-language studies **2010-2024** using OTA-OFC; databases included **Google Scholar, PubMed/MEDLINE**	Studies using OTA-OFC for clinical/research assessment of open fractures.	OTA-OFC usage, benefits and limitations; compared with background Gustilo-Anderson limitations.	Concluded OTA-OFC provides more detailed classification and better outcome prediction in some settings, but **complexity limits routine use**. Gustilo-Anderson remains widely used but is criticized for **poor reliability** and limited outcome measures.	Current evidence supports supplementing Gustilo-Anderson with more detailed domain-based assessment rather than using it alone.
Li et al./PREP-IT Investigators, 2025, Multicentre international	**Retrospective cohort study** using PREP-IT randomized-trial data.	**3,338 patients** with **3,627 open fractures**.	Open fractures from PREP-IT trials. OTA-OFC and Gustilo-Anderson determined by treating surgeon at initial debridement; OTA-OFC3 derived from highest OTA-OFC domain score.	**OTA-OFC3 vs full OTA-OFC vs Gustilo-Anderson** for SSI and unplanned reoperation within **1 year**.	SSI occurred in **11%** and unplanned reoperation in **15%**. SSI prediction AUC: OTA-OFC3 **0.61**, Gustilo **0.63**, full OTA-OFC **0.64**. Reoperation AUC: OTA-OFC3 **0.62**, Gustilo **0.63**, full OTA-OFC **0.69**; full OTA-OFC better than OTA-OFC3 (P<**0.001**).	Simplifying OTA-OFC reduced prognostic information. Gustilo-Anderson performed similarly to OTA-OFC3 for SSI/reoperation, but full domain-based OTA-OFC retained added value.
Schade et al., 2025, Malawi	**Prospective cohort study** in a low-income country.	**287 adults** with open tibia fractures; **252 photographs (88%)** and **274 radiographs (95%)** available for review.	Adults with open tibia fractures across **6 hospitals in Malawi**. Outcomes assessed at 6 weeks, 3 months, 6 months and 1 year.	Gustilo-Anderson, OTS, Muller and Tscherne classifications vs function, FRI and amputation.	Correlation with 1-year function: OTS **0.34**, Gustilo **0.18**, Tscherne **0.17**, Muller **-0.02**. Correlation with FRI: OTS **0.34**, Gustilo **0.31**, Tscherne **0.24**, Muller **-0.02**. Correlation with amputation: OTS **0.39**, Gustilo **0.24**, Tscherne **0.24**, Muller **0.12**.	Most systems had weak/negligible outcome correlation in Malawi. Gustilo retains some correlation but is inadequate as a universal prognostic tool across settings.
Natoli et al./FLOW and PREP-IT Investigators, 2025, International multicentre	**Large contemporary descriptive cohort** from prospective clinical trials.	**6,042 open fractures** from FLOW and PREP-IT trials.	Patients with open fractures in large prospective trial datasets with adjudicated SSI and delayed union/nonunion outcomes.	Outcomes stratified by **Gustilo-Anderson grade**.	Cumulative **12-month SSI** by grade: Type I **5.1%**, Type II **9.7%**, IIIA **13.8%**, IIIB **28.9%**, IIIC **26.2%**. Delayed union/nonunion: Type I **3.0%**, Type II **5.2%**, IIIA **8.0%**, IIIB **14.0%**, IIIC **17.0%**.	Strong contemporary evidence that Gustilo-Anderson grade still stratifies infection and union risk, but IIIB/IIIC overlap and other factors remain important.
Okuku et al., 2025, Uganda	**Prospective cohort study** of GHOISS in Gustilo IIIA/IIIB tibial fractures.	**49 Gustilo IIIA/IIIB tibia fractures** analysed after excluding small paediatric subgroup; **43 salvaged**, **6 amputated**.	Adults with Gustilo type IIIA/B open tibia fractures at two tertiary hospitals in Uganda. GHOISS scored independently; salvage decisions made irrespective of GHOISS. Follow-up **14 days** for early failure.	GHOISS threshold performance in **Gustilo IIIA/B** injuries.	GHOISS cut-off **13**: sensitivity **83.3%**, specificity **90.7%**, AUC **0.923** (95% CI **0.804-0.977**) for predicting amputation/early salvage failure.	Gustilo-Anderson identifies the severe injury group, but additional scores such as GHOISS provide better decision support for salvage/amputation in type IIIA/B tibial injuries.

Section 3: Results summary write-up

The included studies show that Gustilo-Anderson remains clinically meaningful but incomplete. The original 1976 series reported a prospective infection rate of 2.5% after a standardized protocol and reduction in Type III infection from 44% to 9%, establishing the system as a practical severity framework [1]. The 1984 refinement demonstrated strong prognostic separation within Type III injuries: wound sepsis was 4% for IIIA, 52% for IIIB and 42% for IIIC, while amputation rates were 0%, 16% and 42%, respectively [2]. Contemporary large trial data continue to show increasing 12-month SSI and delayed/nonunion across grades, with SSI rising from 5.1% in Type I to 28.9% in IIIB and 26.2% in IIIC [24]. However, reliability is a persistent weakness. Horn and Rettig reported only moderate agreement, Brumback and Jones found average agreement of 60% among 245 surgeons, and Ghoshal et al. found kappa 0.44 for Gustilo-Anderson compared with 0.49 for OTA-OFC [4,5,11]. Several comparative studies show that domain-based systems capture clinically important information missed by Gustilo-Anderson. Hao et al. found Gustilo-Anderson did not correlate with primary outcomes, while OTA-OFC score >=10 predicted amputation with sensitivity 79% and specificity 94% [10]. Kovvur et al. showed Gustilo-Anderson poorly captured contamination, and Khoury et al. found Gustilo and OTA-OFC had identical FRI AUCs of 0.66, but adding embedded contamination improved explained variance from 72% to 84% [18,19]. Specialty and contextual studies show further limitations in paediatric, hand, gunshot and low-income settings [3,8,14,20,23].

Section 4: Discussion

Gustilo-Anderson remains valid in the sense that it provides a shared language for broad open-fracture severity, particularly in long-bone and tibial injuries. Its historical value is not merely descriptive: the 1984 IIIA/IIIB/IIIC subdivision separated injuries by soft-tissue coverage and vascular injury and showed large differences in sepsis and amputation [2]. This broad prognostic relationship remains visible in modern datasets; Natoli et al. showed clear stepwise increases in SSI and delayed union/nonunion across Gustilo grades in 6,042 fractures [24]. Khoury et al. also found Gustilo-Anderson performed as well as OTA-OFC for fracture-related infection in open tibia fractures, with both achieving AUC 0.66 [19]. Thus, for broad communication and initial risk stratification, the system remains valid.

Its limitations are equally important. First, reproducibility is limited. Horn and Rettig, Brumback and Jones, and Ghoshal et al. all found only moderate or poor agreement, which undermines use as a precise research comparator or definitive treatment determinant [4,5,11]. Secondly, the system is not sufficiently granular. OTA-OFC and related systems separate skin, muscle, arterial injury, contamination and bone loss, and several studies show these domains predict treatment burden, amputation, nonunion or infection [6,9,10,16,18,19,22]. Gustilo-Anderson particularly underrepresents contamination, which is clinically important for infection risk [18,19].

Thirdly, validity is context-dependent. The system was developed mainly from long-bone/tibial injuries and may be less suitable for hand fractures, paediatric injuries, civilian gunshot wounds or low-resource contexts [3,8,14,20,23]. For example, paediatric wound-size thresholds require scaling [8], hand-specific systems are more reliable than Gustilo-Anderson for open hand fractures [14], and OTS reclassification was possible in only 47.5% of cases in a high civilian-gunshot cohort because many wounds healed by secondary intention [20].

The best interpretation is therefore not that Gustilo-Anderson should be abandoned, but that it should no longer be used alone when more detailed prognosis or treatment planning is required. It remains a valid broad classification for communication, audit and initial treatment stratification, but it should be supplemented by domain-based assessment of contamination, muscle viability, arterial injury, bone loss, soft-tissue reconstruction requirement, host factors and anatomical context. In type III tibial injuries where salvage/amputation decisions are central, scores such as GHOISS may add important decision-support beyond Gustilo grade [25].

Section 5: Risk of bias of included studies

MODERATE overall. The evidence includes several large prospective or trial-derived datasets and multicentre cohorts, which strengthens confidence in broad prognostic findings [17,22,24]. However, many studies are retrospective, single-centre, reliability-based, or classification-development studies rather than prospective validation studies. Older foundational studies reflect historical treatment pathways. There is heterogeneity in fracture location, timing of classification, outcome definitions, follow-up duration, and healthcare context. Specialty studies in paediatric, hand, gunshot and low-resource settings improve generalisability but also increase clinical heterogeneity.

Section 5: Response/Recommendation

The Gustilo-Anderson classification remains a valid broad tool for describing open injuries and stratifying infection/amputation risk, especially in long-bone and tibial fractures. It should not be used as a stand-alone modern prognostic or treatment-decision tool; it should be supplemented by domain-based or context-specific assessment such as OTA-OFC, OTS, GHOISS or anatomical-region-specific systems where relevant.

Section 6: Level/ strength of Evidence:

MODERATE evidence. The conclusion is supported by multiple observational studies, reliability studies, contemporary trial-derived datasets, and systematic review evidence. Strength is limited by the predominance of non-randomized designs for classification validity, heterogeneity of populations and outcomes, and inconsistent superiority of newer systems over Gustilo-Anderson.

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