

A SURVEY OF CURRENT STATE OF ORGANIZATION AND TRAINING IN MICROSURGERY AND ORTHOPLASTY IN ITALY BETWEEN ORTHOPEDICS

Emanuele Gerace¹, Pierluigi Tos², Alessandro Crosio²,
Vincenzo Caiaffa³, Erika Maria Viola¹

¹ Orthopedics and Traumatology Unit, "Maggiore Hospital" ASST Cremona, Cremona, Italy; ² Hand Surgery and Reconstructive Microsurgery Unit, Orthopedic Institute G. Pini-CTO, Milan, Italy;

³ Department of Orthopaedics and Traumatology, Di Venere Hospital, Bari, Italy

Summary

Objective. Complex limb traumas often involve both bone and soft tissue and can undermine the survival of the patient. In recent decades, with the spread of microsurgical techniques, it has been possible to treat both soft tissues and bone lesions at the same surgical moment. The purpose of this study is to evaluate the orthoplastic and microsurgery skills of Italian orthopaedists and their perception about the trauma network.

Methods. An anonymous questionnaire of 24 questions was formulated and sent, between October 2022 and February 2023, to all members of two orthopaedic scientific societies: O.T.O.D.I (Ortopedici Traumatologi Ospedalieri D'Italia) and WOW (Women in Orthopedics Worldwide) Italia.

Results. The survey was answered by 224 orthopaedists. 60% have not received any training in microsurgery and only 4% intend to start a training course in this field. More than 60% of the sample of orthopaedists who do not work in a microsurgery or orthoplastic center reports that they can hardly direct a patient to a reference center. 83% of them believe that some patients they treated could have benefited from microsurgery or orthoplastic expertise. 94% of respondents believe that the network of trauma centers in Italy would benefit from a greater spread of microsurgery and orthoplastic centers.

Conclusions. This survey shows that a comprehensive network of reconstructive centers is a major need for the orthopedist working in a trauma setting. The current orthoplastic network unfortunately still does not fully permeate the entire national territory and microsurgery is not yet evenly spread.

Key words: orthoplasty, microsurgery, reconstructive, complex limb injuries, traumatology, orthopedics, trauma center, education

Received: September 26, 2023
Accepted: November 20, 2023

Correspondence

Emanuele Gerace

Orthopedics and Traumatology Unit "Maggiore Hospital" ASST Cremona, viale Concordia 1, 26100, Cremona, Italy
E-mail: emanuele.gerace@gmail.com

How to cite this article: Gerace E, Tos P, Crosio A, et al. A survey of current state of organization and training in microsurgery and orthoplasty in Italy between orthopedics. PRRS 2023;3:92-97. <https://doi.org/10.57604/PRRS-342>

© Copyright by Pacini Editore Srl



OPEN ACCESS

This is an open access article distributed in accordance with the CC-BY-NC-ND (Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International) license. The article can be used by giving appropriate credit and mentioning the license, but only for non-commercial purposes and only in the original version. For further information: <https://creativecommons.org/licenses/by-nc-nd/4.0/deed.en>

INTRODUCTION

Patient care is in continuous evolution and quality of life is constantly improving at many levels in developed countries. Specialization in medicine and surgery firmly decreased morbidity and mortality for many diseases, including traumatic and oncological fields ¹.

Treating major limb traumas opens a range of alternatives. Historically “life before limb” always guided the physician to take radical solutions in the pre antibiotics era and also in the last century, in trench and wartime. If amputation always had bad connotations, nowadays collaborations of several specialties including psychiatrists, physiatrists and new materials and sophistication of prosthesis reduced disability and increased function and reliance of devices²⁻⁶.

Development of new surgical techniques in the last five decades opened a new range of alternatives where limb reconstruction became a conceivable way. Microsurgery gave the opportunity to cover even large soft tissue or bone defects and to reimplant extremities. Management of such complex cases requires reorganization of the hospitalization even from the access to the emergency room and of the surgery units.

Treating both bone and soft tissue or vasculonervous lesions can't be taken forward from a single point of view but “the principles and practices of two specialties applied to a clinical problem by either a single practitioner, or a team of practitioners working together for the patient's benefit”. Orthopedic and plastic expertises can't run in parallel lanes^{3,7-9}.

Complex limb injuries are lesions harming the survival of the anatomical district involved and potentially impacting the survival of the patient in the days post trauma. Bone and soft tissues must be involved. Skin can be close or open and so fractures. Crush syndrome often can be an underestimated lesion with a terrifying events cascade. Vascular lesions need to be assessed at first glance in emergency room and periodically reevaluated. High level of disability is reported in the first two years after this kind of trauma. Complex limb trauma necessitates multidisciplinary. Bony restoration and soft tissue coverage are the goal of treatment. Classically, expertise in bone fixation can be found in orthopedic surgeons and management of soft tissue with flaps and microsurgery techniques rely on the plastic surgeon. Optimizing the treatment to effectively treat all the tissues with a comprehensive therapeutic plan facilitate healing, accelerate return to function and reduce disability in the long term. This cross-disciplinary approach is orthoplasty.

In Italy trauma centers don't have a structured organization standard for complex limb traumas, shared among regions. They may be addressed to hospitals differing in dimensions and organization that can answer to the “hub and spoke” logic¹⁰. If in some regions there is a strong connection between the two, especially for hand neurovascular traumas, in other regions and for complex limb injuries the path can be rough.

Even in hub centers collaboration and partnership between orthopedic and plastic specialties can be faint

and access to microsurgical resources maybe delayed or hardly organized, notably in the urgency/emergence setting. Considering these assumptions the window of opportunity between a reconstructive or an amputative plan is narrower.

This study aims to provide information about the permeation of microsurgery and orthoplastic organization in Italy among orthopedic and traumatology surgeons, their perceived importance of microsurgery training, exploring challenges and limits of the healthcare in acute treatment of complex limb injuries and how Italian surgeons would imagine the trauma network.

METHODS

A 24 questions anonymous web-based survey was developed using Google Forms (Google LLC, Mountain view, California, USA) and drawn to attention of all the members of the Italian Society of hospital orthopedics and traumatologists (O.T.O.D.I.) and the members of the Italian branch of WOW (Women in orthopedics worldwide). To maximize participation, it was sent by email in the official mailing list with reminders between October 2022 and February 2023. Distribution within a microsurgery, hand or orthoplastic organization would surely have had a better reception but it would have offered a partial and flawed view of the trauma network. For ensuring reliability the questionnaire was formulated including “alternate form” questions and to increase validity some scenarios were taken for e.g. A requirement of minimum number of answers was established for submission and some questions were mandatory. There were 23 multiple choice questions and one open-ended comment.

Survey comprised three discrete sections focusing on demographics, quality and method of training and local trauma network organizational modalities.

Data were collected using Excel (Microsoft Corp, Redmond, USA).

RESULTS

Two-hundred-twentyfour response were obtained. The demographic aspects showed that 49% of the interviewees were between 30 and 40 years old, 21% were between 41 and 50 years old (Fig. 1). 59% were male and 41% were female. More than 80% work in a trauma center. 77% of all the participants completed their residency program. About half did not receive any kind of plastic surgery knowledge during their post-graduate training. About 60% of the interviewees did not receive any form of microsurgery training (Fig. 2) and only 23%

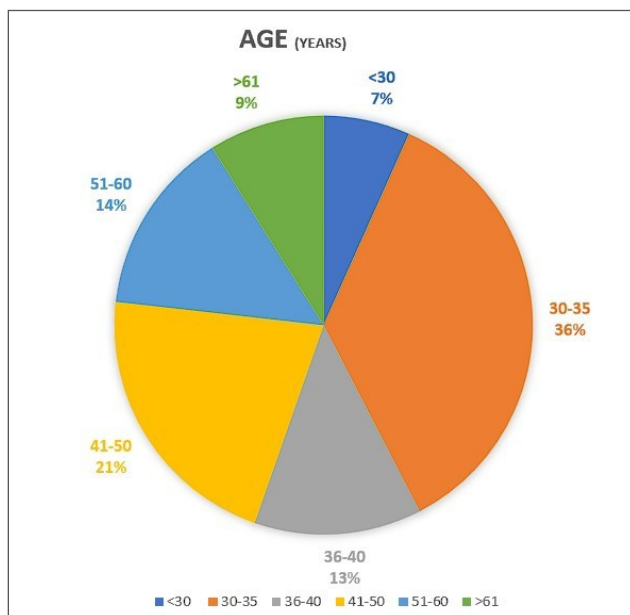


Figure 1. Age of the interviewees.

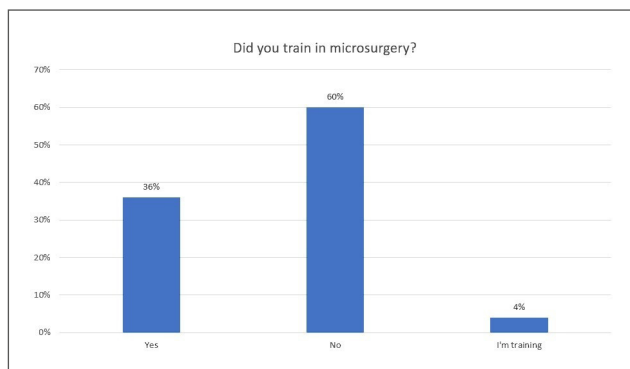


Figure 2. Percentage of the orthopedists trained in microsurgery.

of them obtained advanced certified skills (Fig. 3). 67% of orthopedists without any experience in microsurgery are not willing to start any kind of training program. Only 40% of the participants know the BAPRAS/BAO¹¹ recommendation for treatment of leg open fractures (Fig. 4). 14.4% of the interviewees works in a microsurgery or orthoplastic center. 80% of them thinks their hospital does not confer appropriate resources to their unit. About 70% of the surgeons who don't work in an orthoplastic/microsurgery center refers their hospital does not have any kind of dedicated service to treat complex limb injuries even if about 90% of them believe some patients they had in charge probably would have benefited of a different treatment (Fig. 5). More than 60% of the surgeons who don't work in an orthoplastic

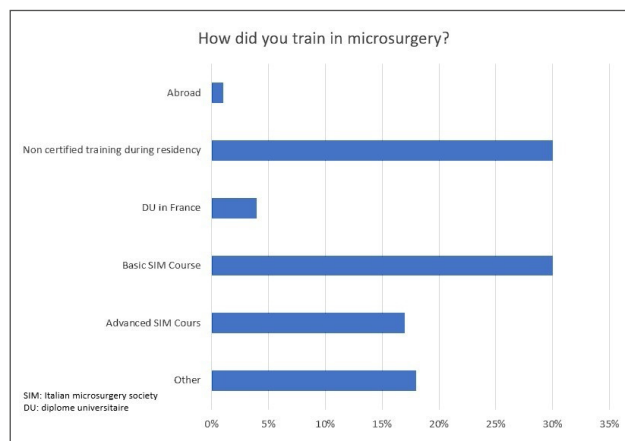


Figure 3. Microsurgery training methods.

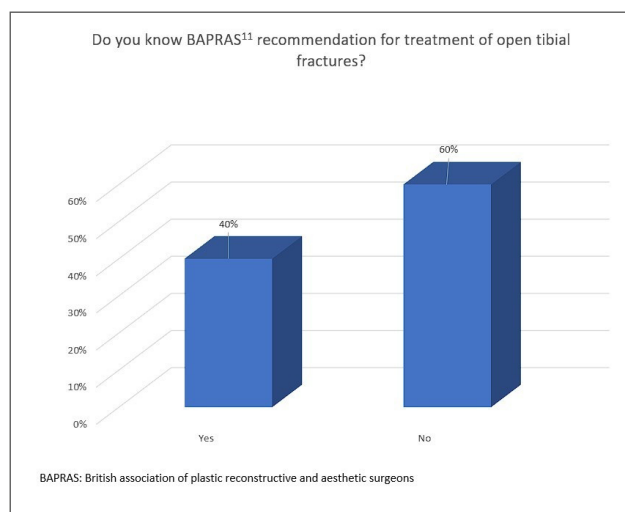


Figure 4. Percentage of orthopedists who are familiar with BAPRAS/BAO recommendation for open tibia fractures (from Nanchahal et al., 2009, mod.)¹¹.

center find any kind of difficult in addressing a patient to a reconstructive center, even out of an emergency context (Fig. 6). 95% of the participants believes Italian trauma network would benefit from a more widespread of orthoplastic or microsurgery centers.

DISCUSSION

Provide an adequate care of complex limb injuries is a big concern nowadays. The traditional orthopedic approach to primary fixes the bone and to delay an effective treatment of the soft tissues has many drawbacks. If the majority of hospitals can take advantage of the presence of the orthopedic surgeon, a plastic service

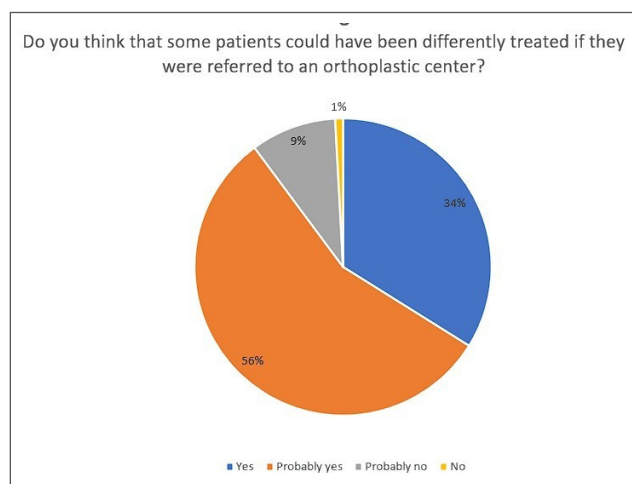


Figure 5. For the orthopedists that don't work in an hospital with microsurgery or orthoplastic unit, a consideration about their treatment of complex limb injuries.

within is not common, especially in medium and small trauma centers. In addition, not all the plastic surgeons are experienced in limb reconstruction, even if they possess skills in microsurgery⁶. In England there are an estimated 20.000 cases of major trauma per annum, resulting in approximately 5.400 deaths annually¹²⁻¹⁴. According to the WHO (World Health Organization), extremity trauma affects more than 20 million individuals per year¹⁵. Legs are one of the most involved districts in complex injuries. Open tibia fractures represent¹⁶ nearly 40% of all long bone fractures. Given the anatomic characteristics they are prone to soft tissue damages and vascular lesions. Deep infection and risk of malunion/nonunion are common complications of open tibia fractures and they are associated with higher social costs¹⁷⁻¹⁹. Since the '90s surgeons benefited of the temporary NPWT to care for soft tissue damages in the expectation of a definitive reconstruction. Unfortunately seeking to avoid microsurgical reconstruction prolonging NPWT has been associated with high infection rates including osteomyelitis²⁰.

The concept of a comprehensive treatment of the injured limb starts in the 16th century with Jean-François Malgaigne, Ambroise Pare, Guillaume Dupuytren and Alfred Velpeau^{21,22} but it was during the 60's and 70's that the groundwork for modern orthoplastic has been laid²³⁻²⁵. Microsurgery opened the borders to flaps, replantation and allo-replantations. During the 90's it was Godina who described the one step procedure for both soft tissues and bone in one surgical time. As a result of this many studies²⁶⁻²⁹ described the benefits of this cross-sectional approach, as reduction of nonunions, infections and better long-term outcomes.

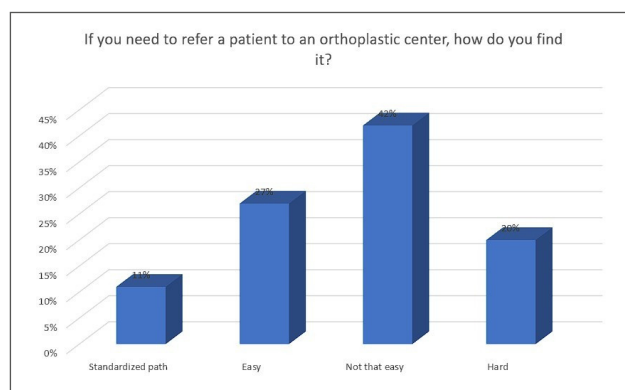


Figure 6. For the orthopedists who don't work in an hospital with microsurgery or orthoplastic unit, their difficulty to refer a patient to a center with those resources.

In 2009 the BOA (British Orthopaedic Association) and BAPRAS (British Association of Plastic, Reconstructive and Aesthetic Surgeons) released the standards for treatment of open fractures, including the concept of one step procedure¹¹. Several authors claimed benefit of an even more radical approach^{11,30,31}. Interviewees of this survey also believed some of their patients could have been treated differently, with different resources. In UK the advent of major trauma centers (MTC) provided significant improvements in complex limb injuries. Reorganization of the trauma chain from the treatment at the location of the event to the appropriate trauma center for the acute treatment improved patient's outcome^{2,8,13,32}.

In Italy we have 634 hospital facilities with urgency unit. They are categorized into three complexity levels: PS, I level DEA (Department of Emergency), II level DEA. While PS are the smallest facilities with basic services, I Level DEA are the spoke hospitals, II level DEA are the hub with the highest specializations regarding the urgency setting. Requirements for the hub centers are both qualitative (mandatory services, special geographical areas) and quantitative (catchment area, number of beds)^{10,33}.

Permeation of microsurgery capabilities in Italian orthopedics, even if steadily increasing, is still low as confirmed in this survey. Furthermore, although its importance is well recognized, fewer than half of the interviewees without any training in microsurgery plans to starting on.

There are 101 II Level DEA and 239 of I level. Only 34 hospitals host a reconstructive and microsurgery center, organized in unit, service or with a described activity of reconstructive surgery included in the orthopedic or plastic unit. Most of them are in the north/center Italy and there are regions without a consistent

reconstructive or microsurgery urgency activity³³. The results of this survey reflect the reality of the Italian trauma network.

Official epidemiological data are unavailable. As things stand, they will be unavailable. Ministerial notifications may include “leg wound” or “open tibia fracture” without discriminate the severity of the clinical picture. Therefore, a posteriori, it can be challenging to determine the number of patients who could have benefited from microsurgery and an orthoplastic treatment. Hospital reimbursements for microsurgical treatments in Italy do not match indeed the actual surges committed by the hospital. Worth considering that countries with a decades-long established path for complex limb injury still experience a strong debate about the right allocated resources¹⁴. In Italy a true epidemiological picture would help in determining the cost of a delayed treatment or of the complications of an insufficient therapeutic path nowadays. Patients with complex limb injuries are usually in working age^{5,14,18,19}.

CONCLUSIONS

Results of this survey demonstrate that creating a comprehensive network of reconstructive centers is a major need for the orthopedic surgeon working in a trauma setting. It is beyond doubt that from a sharing standpoint of expertise and resources, a greater permeability of microsurgery training and experience would be advisable, even only to screen the right patient to centralize in a reconstructive trauma center, knowing the limits of orthoplasty, or to aid the first surgeon operator in a microsurgical case. In our opinion, a mandatory basic training in micro- and reconstructive surgery during the residency program for orthopedic and plastic surgeons, supported by an official independent organization as the Italian Society of microsurgery (S.I.M.) would be advisable.

CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

FUNDING

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

AUTHOR CONTRIBUTIONS

EG: A,W,S,DT,C

PT: DT, A

AC: DT, A

VC: DT

EV: DT, A

Abbreviations

A: conceived and designed the analysis

D: collected the data

DT: contributed data or analysis tool

S: performed the analysis

W: wrote the paper

O: other contribution (specify contribution in more detail)

ETHICAL CONSIDERATION

Ethics approval was not required for this original article. Participation in the survey was voluntary.

References

- 1 Geneva. World Health Statistics 2021: Monitoring Health for the SDGs, Sustainable Development Goals. World Health Organization, 2021.
- 2 Khan U, Kelly MB, Pleat J, et al. Orthoplastics: an integral evolution within comprehensive trauma care. *Injury* 2011;42:969-971. <https://doi.org/10.1016/j.injury.2011.07.022>
- 3 Levin LS. What is orthoplastic surgery? *Orthoplastic Surgery* 2020;1-2:1-2. <https://doi.org/10.1016/j.orthop.2020.11.002>
- 4 Levin S, Erdmann D. Primary and secondary microvascular reconstruction of the upper extremity. *Hand Clin* 2001;17:447-455.
- 5 MacKenzie EJ, Jones AS, Bosse MJ, et al. Health-care costs associated with amputation or reconstruction of a limb-threatening injury. *JBJS* 2007;89:1685-1692. <https://doi.org/10.2106/JBJS.F.01350>
- 6 Lerman OZ, Kovach SJ, Levin LS. The respective roles of plastic and orthopedic surgery in limb salvage. *Plast Reconstr Surg* 2011;127. <https://doi.org/10.1097/PRS.0b013e3182006962>
- 7 Azoury SC, Stranix JT, Kovach SJ, et al. Principles of orthoplastic surgery for lower extremity reconstruction: why is this important? *J Reconstr Microsurg* 2021;37:42-50. <https://doi.org/10.1055/s-0039-1695753>
- 8 Wright T, Chummun S, Chapman T, et al. Role of plastic surgeons in major trauma centres in the UK. *The Bulletin of the Royal College of Surgeons of England* 2015;97:445-447. <https://doi.org/10.1308/rcsbull.2015.445>
- 9 Cervelli V, Longo B. Plastic and reconstructive surgery: roots and future direction of a constantly evolving discipline. *PRRS* 2022;1:49-50. <https://doi.org/10.57604/prrs-090>
- 10 Regolamento recante definizione degli standard qualitativi, strutturali, tecnologici e quantitativi relativi all'assistenza ospedaliera. GU 4 June 2015, n 127.
- 11 Nanchahal J, Nayagam S, Khan U, et al. Standards for the management of open fractures of the lower limb. BAPRAS Published online 2009.
- 12 NAO. Major Trauma Care in England Office, 2010.
- 13 Sargazi NA, El-Gawad B, Narayan. A full time regional orthoplastic unit; initial results. *J Plastic Reconstr Aesth Surg* 2016;69. <https://doi.org/10.1016/j.bjps.2015.12.005>

- ¹⁴ Strong B, Chin YR, Eardley W, et al. Orthoplastics, tariffs and the reality of providing complex fracture care. *Injury* 2020;51:1823-1827. <https://doi.org/10.1016/j.injury.2020.06.027>
- ¹⁵ Global status report on road safety 2018. Geneva: World Health Organization.
- ¹⁶ Weiss RJ, Montgomery SM, Ehlin A, et al. Decreasing incidence of tibial shaft fractures between 1998 and 2004: Information based on 10,627 Swedish inpatients. *Acta Orthop* 2008;79:526-533. <https://doi.org/10.1080/17453670710015535>
- ¹⁷ Yokoyama K, Uchino M, Nakamura K, et al. Risk factors for deep infection in secondary intramedullary nailing after external fixation for open tibial fractures. *Injury* 2006;37:554-560. <https://doi.org/10.1016/j.injury.2005.08.026>
- ¹⁸ Antonova E, Le K, Burge R, et al. Tibia shaft fractures: costly burden of nonunions, 2013 (<http://www.biomed-central.com/1471-2474/14/42>).
- ¹⁹ Kanakaris NK, Giannoudis P V. The Health Economics [Ong-Bone Non-Unions of the Treatment Of.; 2007 (www.elsevier.com/locate/injury).
- ²⁰ Iheozor-Ejiofor Z, Newton K, Dumville JC, et al. Negative pressure wound therapy for open traumatic wounds. *Cochrane Database Syst Rev* 2018;7:CD012522. <https://doi.org/10.1002/14651858.CD012522.pub2>
- ²¹ Ring A, Kirchhoff P, Goertz O, et al. Reconstruction of soft-tissue defects at the foot and ankle after oncological resection. *Front Surg* 2016;3:5. <https://doi.org/10.3389/fsurg.2016.00015>
- ²² Pasquesoone L, Barry L, Sturbois-Nachef N, et al. The interest of "ortho-plastic" collaboration in management of complex limb injury. *Ann Chir Plast Esth* 2020;65:423-446. <https://doi.org/10.1016/j.anplas.2020.05.011>
- ²³ Tamai S. History of microsurgery. *Plast Reconstr Surg* 2009;124(Suppl 6):E282-E294. <https://doi.org/10.1097/PRS.0b013e3181bf825e>
- ²⁴ Jacobson JH, Suarez EL. Microvascular surgery. *Dis Chest* 1962;41:220-224. <https://doi.org/10.1378/chest.41.2.220>
- ²⁵ Godina M. Early microsurgical reconstruction of complex trauma of the extremities. *Plast Reconstr Surg* 1986;78:285-292. <https://doi.org/10.1097/00006534-198609000-00001>
- ²⁶ Jenkinson RJ, Kiss A, Johnson S, et al. Delayed wound closure increases deep-infection rate associated with lower-grade open fractures: a propensity-matched cohort study. *J Bone Joint Surg* 2014;96:380-386. <https://doi.org/10.2106/JBJS.L.00545>
- ²⁷ Mathews JA, Ward J, Chapman TW, et al. Single-stage orthoplastic reconstruction of Gustilo-Anderson Grade III open tibial fractures greatly reduces infection rates. *Injury* 2015;46:2263-2266. <https://doi.org/10.1016/j.injury.2015.08.027>
- ²⁸ Naique SB, Pearse M, Nanchahal J. Management of severe open tibial fracture. The need for combined orthopaedic and plastic surgical treatment in specialist centres. *ne Joint Surg Br* 2006;88:351-357. *ne Joint Surg Br* 2006;88:351-357. <https://doi.org/10.1302/0301-620X.88B3.17120>
- ²⁹ Hull PD. Delayed debridement of severe open fractures is associated with a higher rate of deep infection. *Bone Joint J* 2014;96-B:379-384. <https://doi.org/10.1302/0301-620X.96B3.32380>
- ³⁰ Yang Z, Xu C, Zhu YG, et al. Radical treatment of severe open fractures of extremities by orthoplastic surgery: a 10-year retrospective study. *J Orthop Surg Res* 2021;16:340. <https://doi.org/10.1186/s13018-021-02479-2>
- ³¹ Gopal S. Fix and flap: the radical orthopaedic and plastic treatment of severe open fractures of the tibia. *J Bone Joint Surg Br* 2000;82:959-966. <https://doi.org/10.1302/0301-620x.82b7.10482>
- ³² Gawad A El. The Liverpool Ortho-Plastic Model. *Orthopedics and Rheumatology Open Access Journal*. 2016;3. <https://doi.org/10.19080/oroaj.2016.03.555624>
- ³³ Elenco strutture della rete dell'emergenza ospedaliera. Banche dati – Ministero della Salute (Published online 2021;June 15).