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Focus on Italian hyperbaric centers: lights and shadows in the pediatric field

M. Ciuffreda[1], S. Sorrenti[1,2], L. Brugiaferri[1], E. Pisello[1], G. Ledda[3], C. Piangatelli[1], D. Galante[4]

[1]Anesthesia, Resuscitation, Intensive Care and Pain Management Unit, AST Ancona, Fabriano, Italy
[2]Anesthesia, Resuscitation, Intensive Care and Pain Management, Università Politecnica delle Marche, Ancona, Italy
[3]Indipendent Researcher, Freelance Consultant in Anaesthesia, Resuscitation, Intensive Care and Pain Management Units, Italy
[4]Anesthesia, Resuscitation, Intensive Care and Pain Management Unit, Cerignola, Italy

Corresponding author: M. Ciuffreda, Medical executive in Anaesthesia, Resuscitation, Intensive Care and Pain Management Unit, AST Ancona, Fabriano, Italy. Email: ciuffredamat@libero.it

Keypoints

The article aims to highlight the organizational and management issues of hyperbaric treatment in Italy, particularly in the pediatric field.

Abstract

Hyperbaric oxygen therapy (HBOT) is often underestimated due to limited awareness of its therapeutic potential and the scarce availability of specialized centers in Italy, whose distribution across the country is highly uneven.

There is a noticeable lack of attention to HBOT in the pediatric and maternal-infant fields, which can be attributed to the absence of dedicated training programs, insufficient planning and organization, as well as limited interest from the industry in this sector.

Keywords

Hyperbaric oxygen therapy, hyperbaric chamber, pediatric hyperbaric medicine, pediatric hyperbaric facilities.

Introduction

The indications for hyperbaric medicine are numerous; while some are well established in healthcare professionals' training (such as decompression sickness and carbon monoxide poisoning), others are less known and therefore underestimated. Hyperbaric medicine is often underutilized due to limited awareness of its therapeutic potential and the scarce availability of specialized centers in Italy, whose distribution across the country is highly uneven. The use of the hyperbaric chamber, both in children and adults, can occur in emergency/urgent settings as well as in planned treatments, where time is a critical factor in managing therapy and optimizing outcomes. To date, there appears to be limited attention toward pediatric and maternal-infant hyperbaric medicine (HBOT). Proper planning and adequate management of therapeutic pathways could help optimize and enhance therapeutic effectiveness, reduce post-treatment complications, and lower the resulting impact on healthcare costs.

Analysis

An analysis was carried out on the distribution of hyperbaric centers across the Italian territory (excluding those under military jurisdiction). The logistics were evaluated

in relation to the characteristics of the territory (such as the number of kilometers of coastline) and the number of residents.

Additionally, the organizational structure and management of care pathways for pediatric patients were examined in both public and private centers operating nationwide, along with the training of healthcare personnel.

Discussion

A total of 62 hyperbaric centers are currently active in Italy, according to the 2019 SIMSI report. The centers are distributed as follows (Table 1):

REGION	NUMBER OF CENTERS	POPULATION AS OF 2018	KM OF COASTLINE
Piedmont	2	4.356.406	0
Trentino-South Tyrol	1	1.074.034	0
Lombardy	4	10.010.833	0
Liguria	2	1.550.640	350
Friuli-Venezia Giulia	1	1.210.414	130
Veneto	4	4.884.590	158
Emilia-Romagna	3	4.559.453	141
Marche	2	1.525.271	180
Tuscany	7	3.701.343	633
Lazio	3	5.773.076	361
Molise	1	294.294	35
Campania	11	5.740.291	480
Apulia	4	3.975.528	865
Calabria	2	1.956.687	788.92
Sardinia	2	1.639.591	1897
Sicily	13	4.908.548	1652

Table 1. Distribution of Hyperbaric Centers - SIMSI 2019 Report

The distribution of centers is highly varied, showing a non-uniform spread across the national territory that may compromise and/or delay the initiation or execution of hyperbaric oxygen therapy (HBOT). Among the various regions, there is a significant discrepancy in the number of active centers; some regions do not have any hyperbaric centers at all, which inevitably represents a major critical issue for therapeutic availability. Regions with more active centers have, in most cases, not planned a uniform coverage of their territories. There is also no direct proportionality between the number of residents and the number of operational facilities. Furthermore, it should be considered that due to tourist flows, many regions experience strong fluctuations in population during certain periods of the year, which exacerbates an already limited therapeutic offer. The distribution of facilities does not appear to take territorial characteristics (such as ports, road networks, etc.) into account, and there is no direct proportionality between the kilometers of coastline and the number of operating centers. Overall, regions with greater availability tend to be those with direct access to the sea and islands within their jurisdiction. There is also a marked shortage of facilities in mountainous areas, which is a clear critical issue for the treatment of carbon monoxide (CO) poisoning, which in Italy still occurs more frequently in rural areas (especially in winter). From the distribution of centers (more concentrated in areas with access to the sea), it emerges that the therapeutic indication of hyperbaric medicine that seems to receive the most attention is decompression sickness. Many of the facilities are the result of private entrepreneurial initiatives, and as a result, there does not appear to be adequate planning by the competent authorities. The location of centers outside hospital facilities can make patient treatment difficult, especially for critical patients. Treating an intensive care patient inside a hyperbaric chamber is a complex process: many hyperbaric centers lack the facilities, equipment, and trained personnel necessary for adequate care. Patients admitted to pediatric intensive care are constantly monitored by

specially trained nurses and highly specialized medical staff. This level of medical and nursing training cannot be guaranteed permanently at all hyperbaric centers. The hyperbaric facility is rarely located in close proximity to the intensive care unit, which necessitates repeated patient transfers, with all the technical, logistical, and clinical complexities involved. In light of all this, the decision to treat a pediatric intensive care patient with HBOT must be made after careful risk/benefit analysis concerning the specific characteristics of both the hyperbaric center and the patient's clinical condition. The facilities operating throughout the territory often do not communicate with each other; there is no network of hyperbaric centers, resulting in highly heterogeneous and often incomplete data and statistics. Both nationally and internationally, there is a lack of guidelines and good clinical practices specifically aimed at pediatric and maternal-infant patients. This clearly demonstrates a lack of attention to hyperbaric medicine in the pediatric field. The organization and management of centers are primarily focused on adult patients, also from a purely entrepreneurial perspective, given the significantly smaller pediatric patient base. Few centers have a predominantly pediatric focus and/or are located within maternal-infant hospital facilities. Due to its structure and characteristics, the hyperbaric chamber can be difficult for pediatric patients to accept. The industry has devoted little attention to pediatric patients: there are still real difficulties in finding appropriately sized masks on the market; the environment inside hyperbaric chambers is not very child-friendly; the standard seats, in terms of size and height, are not suitable for small patients, etc. To facilitate the approach for young patients (especially non-critical ones), simple behavioral rules and guidelines should be adopted, such as:

- Treating multiple pediatric patients together to give them the feeling of participating in a game.
- Avoiding simultaneous treatment of an adult and a pediatric patient in the chamber.
- Allowing young patients to be accompanied by a parent up to the chamber entrance.
- Preferably having female staff assist in the chamber, whenever possible.
- Preferring the use of helmets instead of masks, especially for the youngest patients.
- Always providing appropriate background music during treatment.
- Allowing a parent to enter the chamber if the young patient appears particularly resistant to the environment (the parent must undergo prior examination and tests and sign informed consent).
- Involving school-age children in the various phases of treatment.

Such simple rules should be incorporated into facility protocols that each center should have. The adoption of clear, simple, and easily implementable protocols is essential to facilitate and improve pediatric HBOT treatment. The training of healthcare personnel in this field is also inadequate; currently, there are no hyperbaric medicine courses exclusively dedicated to pediatric and maternal-infant disciplines. This shortage is even more pronounced in emergency and critical care settings. Adequate training is essential not only to ensure proper treatment but also to reduce the incidence of adverse events.

Conclusion

Attention to pediatric patients requiring hyperbaric therapy is currently significantly limited. Greater planning in the distribution of hyperbaric centers across the territory is desirable, along with the adoption of national and international guidelines aimed at pediatric and maternal-infant patients, as well as the development of internal protocols to facilitate management and treatment. Strengthening training in hyperbaric medicine for pediatric patients, especially those who are critical, and for the maternal-infant field should, in our opinion, be the challenge for the near future.

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