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CLINICAL PRACTICE ARTICLE

Half man, half prosthesis: the rehabilitation of people with hemicorporectomy – case series [version 1; peer review: awaiting peer review]

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Abstract

Hemicorporectomy is a procedure where the lumbar spine and spinal cord, pelvic bones and contents, lower extremities and external genitalia are surgically removed. The rehabilitation process, in addition to being prolonged and costly, is challenging. This article reports the rehabilitation process for hemicorporectomy and shows the innovative solutions for mobility for this disability for two cases of paraplegic patients: case 1 due to traumatic spinal cord injury due to firearm injury and case 2 due to lumbosacral myelomeningocele. They presented chronic pressure ulcer which evolved to neoplastic transformation. (squamous cell carcinoma - Marjolin's ulcer). The cases were submitted to L4 hemicorporectomy and were rehabilitated to ensure the right to mobility independence for activities of daily living; social inclusion; prevention of comorbidities and pluralization of disabilities. The rehabilitation involved the elaboration of a new prosthesis for the hemibody and improvement of functional capacity, within a gain of 6 - 11 points in the Functional Independence Measure (FIM). The principal changes happened in social interaction, locomotion and transfers to a bed/chair and toilet. Despite the body transformation, patients show gains in quality of life mainly for the social domain of World Health Organization Quality of Life instrument-brief version (WHOQOL-bref). In general, there is an increase in the scores of this instrument from 1.78% -19.25%. The evolution of social inclusion through the International Classification of Functioning, Disability and Health (ICF) reveals that patients are able to resume social, working, academic-professional life and recreation and leisure activities, reducing the number of severe and complete qualifiers from 90.91 to 60% when using the products appropriate assistive devices. Hemicorporectomy can be a therapeutic option for those in need, as it

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provides functionality without the need for caregivers and resumes educational, professional, economic and social aspects with gains in quality of life.

Keywords

Assistive Technology, Amputation, Hemicorporectomy, Rehabilitation, Prosthesis, Case Reports

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Introduction

Hemicorporectomy, translumbar amputation or translumbectomy is a procedure indicated to save someone in severe distress and risk of death,^{1,2} where the spine, lumbar spinal cord, pelvic bones and contents, lower extremities and external genitalia are removed surgically.^{3,4}

This permanent body modifying surgery is a treatment, sometimes curative, for trauma, ulcers, neoplasms or locally extensive and advanced pelvic infectious processes, without distances and cannot be controlled by other treatments.⁵⁻⁷ Examples include pelvic traumatic crushing, pelvic osteomyelitis, squamous cell carcinoma, chondrosarcomas, pressure ulcers complicated by Marjolin's ulcer, all situations considered refractory and intractable.^{7,8}

Before amputation, the patient's desire and acceptance, the staging of the disease that motivates the indication (tumour, infection, trauma, wound), the clinical and ethical conditions, the prognosis and the possibility of support and social inclusion of the patient must be considered.^{2,9,10} In other words, the risk of death and willingness to live with functional resumption and not just the chances of survival should be evaluated. The patient's emotional and psychological conditions to understand and deal with the physical, functional and emotional manifestations of hemicorporectomy need to be treated.¹¹

The will to live surpasses body transformation and the challenging rehabilitation process needs to be a priority. Since 1961, the team that operated the first successful case of hemicorporectomy recognizes the importance of physical medicine and rehabilitation in this process.¹² However, in the literature there is nothing specific¹³ about this deficiency, with rehabilitation issues being addressed within articles focused on surgical aspects, despite the importance of carrying out a rehabilitation with a multidisciplinary team.¹⁴

Due to the low frequency of occurrence of hemicorporectomy, there are few opportunities to modify and improve the rehabilitation techniques for this deficiency.

This article aims to present two patients who underwent hemicorporectomy and were rehabilitated, showing innovative solutions to serve as a guide for future patients.

The objectives of the study were to describe the rehabilitation process, innovations in assistive technology for hemicorporectomy, its impact on quality of life and functionality through standardized and validated instruments in the literature.

Case presentation

The report of the rehabilitation of two consecutive cases treated at Instituto de Medicina Física e Reabilitação of the Hospital das Clínicas of the Faculdade de Medicina of the Universidade de São Paulo, SP, Brazil (IMREA-HCFMUSP) was carried out, after receiving patients' written informed consent and approval by the Ethics and Research Committee - Comissão de Ética para Análise de Projetos de Pesquisa - CAPPesq - under number CAAE: 13795619.5.0000.0068, 19th of June 2019.

The evolution of the cases was assessed before and after one year of the rehabilitation process, using standardized instruments, validated for Brazilian Portuguese, applied routinely to IMREA-HCFMUSP patients, below:

- Functional Independence Measure (FIM):¹⁵ evaluates the person's performance in the aspects of activities of daily life. Each item varies in seven levels, with level seven being total independence and level one being total dependency;
- World Health Organization Quality of Life instrument-brief version (WHOQOL-bref):¹⁶ instrument from the World Health Organization (WHO) that assesses quality of life in general;
- Quebec User Evaluation of Satisfaction with Assistive Technology (QUEST 2.0):¹⁷ assesses satisfaction with equipment and service provision. Each item is scored from 1 to 5: 1 (dissatisfied), 2 (somewhat satisfied), 3 (more or less satisfied), 4 (very satisfied) and 5 (totally satisfied);
- International Classification of Functioning, Disability and Health (ICF):¹⁸ 12 descriptors related to social inclusion were selected, which were qualified according to [Figure 1](#).

Qualifier	Magnitude of the impairment	Functional involvement
0	None/absent	0-4%
1	Mild	5-24%
2	Moderate	25-49%
3	Severe	50-95%
4	Complete	96-100%
ICF, International Classification on Functioning, Disability and Health		

Figure 1. International Classification on Functioning, Disability and Health Qualifiers.

Figure 2. Case 1: before and after hemicorporectomy.

Description of cases

Case 1 (Figure 2) - 34 years old, male, five years of schooling, single, without children, without comorbidities, suffered a traumatic spinal cord injury due to firearm injury at the age of 12 (spinal cord injury by firearm injury, level T9, American Spinal Cord Injury Association - ASIA - A), with chronic anemia and recurrent urinary infections, evolving with invasive squamous cell carcinoma at a chronic pressure ulcer site, diagnosed in 2012. He was submitted to 5 surgeries for tumor resection, colostomy, ureterostomy, until L4-level hemicorporectomy was performed in June 2016. Before hemicorporectomy, there was an extensive irregular, ulcerated and infiltrative lesion in the perineal region, compatible with the neoplastic process, but its delimitation is impaired due to the possibility of overlapping the inflammatory/infectious condition; abdominopelvic lymph nodes/lymph nodes, compatible with involvement secondary to the underlying disease; liquid collection in the subcutaneous layer of the lateral aspect of the right hip, a probable inflammatory/infectious process. On physical examination, he presented normal range of motion, with grade V strength of upper limbs and trunk with no sensitivity below the navel, currently weighing 37.7 kg (previous weight before hemicorporectomy = 48 kg; after the surgery, his weight was 28 kg). As a means of locomotion, the patient used a manual wheelchair.

Case 2 (Figure 3), 40 years old, male, 11 years of schooling, married, without children, with paraplegia due to lumbosacral myelomeningocele with ventriculo-peritoneal shunt (currently obstructed), without other comorbidities, he noticed the

Figure 3. Case 2: terminal aspect of the stump after hemicorporectomy.

appearance of pressure ulcers in the gluteal/sacral region 17 years earlier. After therapeutic failure when performing surgeries, radiotherapy, chemotherapy, the surgical procedure of hemicorporectomy was performed, without complications. On physical examination, the patient had a tonic torso with a moderately flaccid lower portion, low coverage of soft tissues, with bony prominence of the lumbar spine very evident, which causes pain when sitting. On physical examination, the patient presented an orifice with a serous discharge in the terminal scar, irregular, erythematous, closed and adhered to the bone support. He had a single stoma without prolapse with wet colostomy for excrement and urine. He presented abdominal muscles with voluntary motor control despite weakness, currently weighing 37.7 kg (previous weight before hemicorporectomy = 48 kg). After the surgery, he presented a terminal portion of the lumbar spine on the abdomen, with soft tissue covering without a muscle pad, with fibrosis and slender loops, a small gastric hernia by sliding, mural thrombi in the distal aorta. As a means of locomotion, the patient used a manual wheelchair.

The both cases presented with chronic pressure ulcer in the gluteal region, with failure of clinical and surgical treatments, which evolved with neoplastic transformation (squamous cell carcinoma - Marjolin's ulcer). The cases were submitted to L4 hemicorporectomy (Figure 4), at 34 years of age and 40 years of age, respectively, with the aim of preserving life, after extensive discussion and acceptance by patients.

At the initial evaluation, the upper limbs were unchanged in good general condition, with ostomies for the elimination of faeces and urine (note in Figure 3C the capacity and strength of the upper limbs to support the trunk). The distal portion of the trunk (residual limb) had no sensation due to spinal cord injury, so there is a risk for pressure ulcers.

In both cases, the level of amputation was below the area of preservation of sensitivity, thus maintaining the major risk factor for the development of pressure ulcers, according to the criteria of the Wheelchair Service Training Package (WSTP) basic level of World Health Organization (WHO),^{19, 20} as shown in Figure 5.

Rehabilitation treatment

The cases were rehabilitated in a similar way, with the following objectives:

- Ensure the right to mobility (home and community);
- Independence for activities of daily living;
- Social inclusion;
- Prevention of comorbidities and pluralization of disabilities.

For each objective, the assistive products most appropriate to the clinical need and environmental characteristics of use²⁰ were selected, together with the patients' wishes, as shown in Figure 6. For social interaction, there was no need for a prosthesis, but the patients wanted to appear in person using prostheses only.

To comply with the proposed objectives, the rehabilitation treatment was divided into two phases: pre-prosthetic and prosthetic.

Figure 4. X-ray after hemicorporectomy. To the right, the Xray of case 1 and to the left, the Xray of case 2.

Factor	Description	Score
Major	the person has altered sensitivity	3
Minors	the person cannot move	1
	Moisture from sweat, water or urinary incontinence	1
	Bad posture	1
	Previous or current ulcer / wound	1
	Inadequate diet and not consuming enough water	1
	Aging	1
	Weight (over or under weight)	1
A person is at risk of pressure ulcers if they have a score greater than or equal to 3 points		
Pressure ulcers are caused by shearing, friction or pressure, closely linked to trauma and tissue ischemia. The risk factors relate to people exposed to them or to loss of defence mechanisms against their action.		

Figure 5. Risk factors for pressure ulcers according WSTP-WHO.

Figure 6. Organization chart of patients' goals and desires with their most appropriate assistive product.

Figure 7. In The folding wheelchair with short distance between the rear and front axles. In B provisional ballast test with ankle dumbbells for counterbalance of forces. In C ballast solution adapted to the wheelchair's footrest.

Pre-prosthetic phase

At this stage, patients received guidelines for the prevention of musculoskeletal injuries and skin wounds. Questions about changes in thermal regulation, risks of hypervolemia, especially in venous hydration, with risk of acute pulmonary edema (due to the lower total body surface area) were explained. They were also trained in stoma care and regular testosterone replacement (gonads were removed).

Hemicorporectomy mobility can be achieved with a self-propelled manual wheelchair, motorized wheelchair or prosthesis. The use of each modality depends on the patient's physical need or environmental situation.²⁰ In situations of indoor mobility for flat paved terrain for short distances with the patient in good clinical condition, prosthesis is an option.

For the mobility of short to moderate distances, indoor or outdoor paved, in which the patient needs agility with energy conservation, the use of the manual wheelchair is the best option.²¹⁻²³ The motorized wheelchair for long to moderate distances for outdoor or indoor environments of large dimensions where energy conservation and speed is needed, is a good solution.

As there are no more lower limbs to counterbalance the forces, a ballast was added to the structure of the footrest of the wheelchair to counteract the forces that predispose to a subsequent fall (Figure 7). A digitized full contact cushion was performed, with pressure in the distal portion of the trunk that touches the cushion not exceeding capillary perfusion pressure (30 mm Hg) (24.25), as shown in Figure 8.

Figure 8. A. Scanning the patient's seat in case 2; B. Scanned cushion; C. Wheelchair with digitized cushion and catenary base (a rounded cut out at the base of the cushion that comes in contact with the canvas seat of the chair that keeps the upper surface of the cushion aligned in the case of the sealing of the chair seat canvas); D. Case 1 patient in a wheelchair with the digitized cushion. Note the alignment and body stability provided by the digitized cushion that obeys the terminal contours of the patient's trunk.

Regardless of the assistive product, the user interface with the equipment (cushion, back or fitting) is of vital importance given the maintenance of pressure injury risk factors: alteration of sensitivity, previous injury and sweat moisture due to the thermoregulatory disturbance by smaller body surface for heat exchange, as shown in Figure 5. As pressure is a function inversely proportional to the area, the larger the contact area the lower the pressure, which was achieved by digitizing the entire contact surface with the patient and making equipment total contact, also avoiding the action of shear and friction forces.

As it is a wheelchair with a canvas seat, with a tendency to sealing, a catenary cut was made at the base of the cushion, which when accommodating itself in the concavity formed by the sealed canvas of the seat, rectifies the upper surface of the cushion, providing a flat base for the patient to sit²⁰ (Figure 7C). In the case of the backrest, in addition to the full contact, an angle of 10 degrees between the seat and backrest (open angle between seat and backrest) was performed to reduce the weight unloading in the terminal portion of the trunk (amputated area), Figure 8A.

Patients have effective adaptive resources, but both had difficulties in the process of grieving and restructuring their body image. Regarding family dynamics, patient 1 refers well-established emotional support by his mother, brother and girlfriend. Patient 2 has good support from his mother and his brother to carry out the activities of daily living.

Patients had high expectations regarding the fitting and rehabilitation process. After understanding the phases required for fitting, the process of acceptance and adherence to treatment was easier. The objectives established by psychology for the rehabilitation process were: to investigate and work on the patient's affective dynamic aspects that may interfere in the rehabilitation process; to provide emotional support and to assist in the planning and organization of future plans aiming a greater well-being, prevention of new disabilities and a better quality of life. Therefore, during the entire process of rehabilitation, there were no adverse or unanticipated events.

Prosthetic phase

The prosthetic challenge was to have a fitting that would allow the coupling of artificial limbs without generating distal pressure and risk for new pressure injuries. A mold was developed under full contact, with partial discharge of body weight on the thoracic wall (Figure 9).

Full contact plus weight bearing on the rib cage allowed relief of distal pressure in the terminal area of the trunk (residual limb), ventilatory dynamics and pressure limitation in the terminal area of the trunk less than 20 mmHg.^{24,25}

This was achieved through a mold performed with the patient in body weight suspension, controlled by measuring the distal pressure in the residual limb up to the limit of 20 mmHg of distal discharge (Figure 9A and B). All of these solutions result from the maintenance of risk factors for recurrence of wounds.

Free hip prosthetic joints were installed with gravity lock, knee with manual lock and SACH foot (Figure 10). The patients only needed eight training sessions to conquer the prosthesis mastery for reciprocated standard gait with walker with anterior wheels, for a maximum of 20 meters in a flat, paved and unobstructed environment.

Figure 9. Making and fitting the basket socket type fitting. In A and B, a vest with a body weight suspension system was installed on plaster splints to make the full contact mould. In C and D we have proof of prosthetic fitting with holes for ostomies.

Figure 10. In A prosthesis in alignment on the workshop bench, in B test (fitting) with the patient.

In the end, both patients use the prosthesis more for aesthetic reasons of social presentation than for everyday functional mobility, which happens preferably in a manual or motorized wheelchair with the prosthesis in a sitting posture (Figure 11).

Functional results and satisfaction of each assistive product

The patients received a manual wheelchair, a motorized wheelchair (motorized wheelchair model B400 Ottobock®) and prostheses so that they could choose the most appropriate equipment for the terrain, the patient's need or the day-to-day situation.²⁰

For each assistive product added, patient satisfaction with QUEST 2.0 and functionality through the FIM were evaluated, as shown in Table 1. It is noted that the standard wheelchair (available on the market) in which rehabilitation started, promotes mobility, but clinically did not control the risk of pressure injuries and falls.

The manual wheelchair with a digitalized full contact cushion, with weight counterweight in the footrest (Figure 7B, C), promoted an increase in function with clinical safety and prevention of falls and recurrence of wounds. The motorized wheelchair with the same type of cushion did not impact functionality and the prosthesis decreased the total FIM score by 25 points in Case-1 and by 27 points in Case-2.

Figure 11. A: motorized wheelchair with prosthesis. B: Manual wheelchair without using the prosthesis. Note the stability of the trunk allowing greater reach of the upper limbs in B, C and D.

Table 1. Functionality and Satisfaction for each assistive product solution for each case.

Product	Propel type	Postural support device	Case 1		Case 2	
			FIM	QUEST 2.0	FIM	QUEST 2.0
Wheel-chair	manual	absent	97		103	
		scanned full contact seat	108	5	109	4,75
Wheel-chair	motorized	scanned full contact seat	108	5	109	4,5
Prosthesis	mechanics	absent	83	5	82	3,42

FIM, Functional Independence Measure; QUEST 2.0, Quebec User Satisfaction Technology 2.0.

Table 2. Evolution of quality of life and functionality with the rehabilitation of Cases 1 and 2.

Instrument (points)	Case 1			Case 2		
	Initial	Final	Dif (%)	Initial	Final	Dif (%)
FIM	96	107	11(11,46)	102	108	6(5,88)
WHOQOL-bref	17,23	17,54	0,31(1,78)	12,00	14,31	2,31(19,25)

FIM, Functional Independence Measure; WHOQOL-bref, World Health Organization instrument to evaluate quality of life, brief version; Dif, difference between Final and Initial in points and (%) percentage.

The satisfaction of Case-1 with assistive products, assessed by QUEST 2.0, was maximum for all equipment (maximum of 5 points) and Case-2 revealed greater satisfaction for the manual wheelchair with digitized full contact cushion (4.75 points), followed by the motorized wheelchair (4.5) and finally the prosthesis (3.42 points), as shown in [Table 1](#).

Functionality, quality of life and social inclusion results

Rehabilitation improved quality of life (assessed by WHOQOL-bref) and functional capacity (measured by FIM), as shown in [Table 2](#). There was a gain of 11 points in the FIM, that is, 11.46% in the initial FIM, and 1.78% in WHOQOL-bref for Case-1. For Case-2, there was a gain of 5.88% in FIM (increase of six points) and 19.25% in WHOQOL-bref.

The function measured by the FIM at the beginning and at the end of the rehabilitation is shown in [Table 3](#), where it is noted that in Case-1 the biggest changes happen in the items Social interaction (gain of five points), followed by Locomotion (walk/wheelchair) and Transfers to a bed/chair and toilet (gain of two points in each). In Case 2, the gain occurs in the same areas (2 points for each area) evenly with the rehabilitation.

[Table 4](#) shows the evolution of quality of life with the rehabilitation process. In Case-1, there is a negative assessment (worsening) related to the Physical domain, with the greatest perception of improvement in the Social Relations domain. In Case-2, on the contrary, the greatest perception of improvement was in the Physical domain (6.86 points).

Table 3. Functionality assessed by the Functional Independence Measure at the beginning and end of rehabilitation in cases 1 and 2.

FIM	Case 1			Case 2		
Item (points)	Initial	Final	Dif	Initial	Final	Dif
Eating	7	7	0	7	7	0
Grooming	6	6	0	6	6	0
Bathing	6	6	0	6	6	0
Dressing - upper body	6	6	0	6	6	0
Dressing- lower body	6	6	0	6	6	0
Toileting	6	6	0	6	6	0
Bladder management	6	6	0	6	6	0
Bowel management	6	6	0	6	6	0
Transfer: bed,chair	4	6	2	4	6	2
Transfer: toilet	6	6	0	6	6	0
Transfer: tub, shower	4	6	2	4	6	2
Locomotion: walk/wheelchair	4	6	2	4	6	2
Locomotion:stairs	1	1	0	1	1	0
Comprehension	7	7	0	7	7	0
Expression	7	7	0	7	7	0
Social interaction	1	6	5	7	7	0
Problem solving	7	7	0	7	7	0
Memory	6	6	0	6	6	0
Total	96	107	11	102	108	6
Improvement (%)	11,46			5,88		

Table 4. Evolution of quality of life by WHOQOL-bref and its domains in both cases.

WHOQOL-bref	Case 1			Case 2		
Domain (points)	Initial	Final	Dif	Initial	Final	Dif
Physical	18,29	17,71	-0,57	7,43	14,29	6,86
Psychological	18,67	18,67	0,00	14,67	15,33	0,67
Social	14,67	17,33	2,67	14,67	14,67	0,00
Environment	16,50	17,00	0,50	12,50	13,00	0,50
Overall	17,23	17,54	0,31	12,00	14,31	2,31

WHOQOL-bref, World Health Organization Quality of Life Assessment Instrument-brief version; Dif, difference between Initial and Final evaluation.

Twelve descriptors from the International Classification of Functioning, Disability and Health (ICF) related to social inclusion were selected, which were qualified according to Figure 1. The result is shown in Table 5 which reveals that in Case-1 except for the descriptor of public transport passenger, there was an improvement in social integration. This patient has functionality to sit, move at home and in the community. Currently, he drives an adapted car, works as a disc jockey (DJ) (Figure 12), gives motivational lectures, organizes parties, becoming an entrepreneur and employing people. He has a married life, bought a house and lives independently without the help of caregivers, being able to support himself and generate income not for himself, his family and employees.

Case-2 (Figure 13) showed functional gains for sitting, home mobility (moving around within the home), relationship with the goods and services market, informal relationships, work (paid) and leisure activities. It maintained restrictions on participation in aspects related to community mobility (individual or collective, as a passenger or driver) and for intimate

Table 5. Functional qualifiers* for 12 ICF descriptors of performance.

Code	Descriptor	Case 1		Case 2	
		Initial	Final	Initial	Final
d4153	Maintaining a sitting position	4	1	4	1
d4600	Moving around within the home	2	1	2	1
d4602	Moving around outside the home and other buildings	4	2	4	4
d4702	Public transport passenger	4	4	4	4
d4751	Private transport driver	4	1	4	4
d6200	Buying goods and services	3	1	3	1
d6504	Domestic services	4	2	4	2
d7509	Informal social relationships	4	1	2	1
d7709	Intimate relationships	4	1	4	4
d8509	Paid work	4	1	4	1
d870	Self economic sufficiency	4	1	4	1
d9209	Recreation and leisure	4	2	4	1

ICF, International Classification of Functioning, Disability and Health.

* Qualifiers comply with Table 2.

Figure 12. In A the complete prosthesis, in B patient using the prosthesis in a motorized wheelchair, in an orthostatic position (C) and next to his DJ equipment (D).

relationships. This patient returned to work as a graphic designer, resumed studies and undertook digital services in the financial and stock market.

Despite his financial success, environmental aspects of the city where he lives hinder his greater participation (lack of public transport, of streets properly paved for wheelchair users and the presence of unfavorable geographic relief with steep and irregular hills and valleys). In addition, he got divorced and started living with his sick mother, assuming the role of caregiver (before he was cared for and became caregiver), limiting his time to dedicate himself to outdoor social activities, as shown in Table 5.

Categorizing functionality by ICF into 2 groups of Qualifiers 3 + 4 (Severe + Complete) and Qualifiers 1 + 2 (None/absent + Moderate), as shown in Table 6, it is noted that Case-1 starts with 11 Serious-Complete descriptors and at the end of the rehabilitation, it presented only 1 in this category, revealing a decrease of 90.91% in severe or complete descriptors. Conversely, he started the rehabilitation with only one functionality descriptor measured as Light and at the end, presented 11 of them qualified as light to moderate, representing a functional gain of 1,000%.

Case-2 started rehabilitation with 10 qualified descriptors as Grave-Complete and two as Mild-Moderate. At the end of rehabilitation, there was a variation of six in each group, representing a 60% decrease in severe-complete descriptors and an increase of 300% in those qualified as mild-moderate.

Figure 13. Case 2 with walking with a walker and prosthesis on flat ground.

Table 6. Evolution of Functionality in Rehabilitation in both cases.

ICF	Case 1			Case 2		
Qualifiers	Initial	Final	Dif	Initial	Final	Dif
3 + 4. n (%)	11 (91,67)	1 (8,33)	10 (90,91)	10 (22,22)	4 (33,33)	6 (60,00)
1 + 2. n (%)	1 (8,33)	11 (91,67)	-10 (1.000)	2 (16,67)	8 (66,67)	-6 (300)

ICF, Classification of Functioning, Disability and Health; n, number of observations; % percentage; Dif, difference between Final and Initial; Qualifier 1, presence of none/absente problem (affects 5-24% of the function); Qualifier 2, presence of moderate problem (affects 25-49% of the function); Qualifier 3, presence of a severe problem (affects 50-95% of the function); Qualifier 4, complete problem (affects 96-100% of the function).

The rehabilitation's adherence was satisfactory and patients maintained home exercises. The adherence was assessed by demonstrating the practice of exercise and also the absent of wounds.

Discussion

Hemicorporectomy is a procedure that involves the removal of a large body mass^{26,27} with perioperative morbidity.²⁸ Ferrara et al²⁹ described the best postoperative result for hemicorporectomy due to pressure ulcers. According to Elliot P et al.,³⁰ patients with paraplegia of congenital etiology have a more facilitated rehabilitation process, because even the paralyzed parts are functional, they learn to take advantage of the full potential for functionality. These facts may have contributed to our results.

In order to have a better discussion on hemicorporectomy, despite the little data in the literature on the subject, we can compare and rely on patients with proximal amputations, such as hip disarticulation and hemipelvectomy - which are closer to hemicorporectomy. These amputations have a higher morbidity, in addition to complications such as wound infections and flap necrosis in the postoperative period and rarely use prostheses,³¹ which is compatible with our findings.

The more proximal the amputation level, the greater the energy expenditure for prosthetic gait.³² In addition, during gait, it is difficult to stabilize, balance and balance with the prosthesis, which often makes the use of prostheses a less functional process in more proximal amputations.^{33,34}

However, with prosthetic advances, patients are increasingly opting for prosthesis for primary locomotion.³⁵ In our work, patients maintained the use of prostheses for outdoor activities, short-distance walking indoors and outdoors for short distances or social presentation.

Rehabilitation in hemicorporectomy is long and difficult, but according to other studies,⁵ many patients have managed to reinsert themselves in the market, returning to preoperative occupations, as well as better quality of life. In our case series, patients achieved the proposed rehabilitation objectives, obtaining an increase in the scores on the ICF, FIM, QUEST2.0 and WHOQOL-bref instruments, revealing that there is daily functionality, social participation and well-being after hemicorporectomy.

The patient in the first case, previously without income and dependent on government benefits, became an employer, had more social life, married and improved his economic conditions and those of his relatives. The patient in the second case went from unemployed to two jobs, improving his working condition and social life.

In the daily clinical practice of our institution, people with paraplegia consider the idea of removing the lower limbs and imagine how they would be functional without the legs. Evidently, this type of conduct cannot be proposed or practiced. However, these two cases reveal that in extreme situations, with risk of death and failure of previous attempts, being without the lower limbs through a definite body modifying procedure can be the solution that is not restricted to just a question of survival, but also provides real gains in functionality, social participation and productive life.

As hemicorporectomy is a rare procedure, we only report two cases here. Although there is no variation in the surgical technique so far, postoperative management, environmental conditions and social support were different for each case, which makes it difficult to form a homogeneous group.

We only review the patients medical records, which limits the amount of data that can be collected. Adaptation to the use of the prosthesis could be better observed if a longer follow-up time was considered.

This is the first series of cases with measurement of results using cross-cultural, quantitative and internationally validated instruments.

Conclusion

Hemicorporectomy can be a therapeutic option for those in need, as it provides functionality without the need for caregivers and resumes educational, professional, economic and social aspects with gains in quality of life.

Data availability

All data underlying the results are available as part of the article/references and no additional source data are required.

Consent

Written informed consent for publication of their clinical details and/or clinical images was obtained from the patient/parent/guardian/relative of the patient.

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