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Orthopedic Sequelae in Patients with Meningococccemia: A Case-Based Review with Literature Analysis

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ILLR
Ilizarov - limb lengthening and reconstruction





Introduction

- Bacterial Meningitis: an infectious disease with high incidence and mortality
- Etiology: *Neisseria meningitidis*, *Streptococcus pneumoniae*, and *Haemophilus influenzae* type B
- Brazil - 2020 (Jan–Aug): 1,731 cases, 10.86% mortality.
- Florianópolis (1994–2012): 791 hospitalizations.





Introduction

Sequelae

- Behavioral changes – 40%
- Motor impairment – 12.3%
- Hearing loss – 31.3%



• Orthopedic sequelae:

- Physeal destruction
- Angular deformity
- Amputation





Introduction

Pathophysiology of Orthopedic Sequelae

- Toxin causes acute vascular injury.
- Thrombosis, necrosis, and tissue hemorrhage.
- DIC leads to osteonecrosis or physeal avascular necrosis.





Introduction

Clinical Presentation

- Involvement of tibial and femoral metaphyses and epiphyses
- Limb length discrepancy
- Angular deformity
- Necrosis

Diagnosis: Clinical and X-ray; usually years after meningitis.





Introduction

Treatment: Surgical Interventions

- Osteotomies
- Epiphysiodesis
- Bone lengthening
- Amputation



Appel, 2002; Belthur, 2005; Wick, 2013



Objective

- Compare orthopedic sequelae from our institution with global reports.
- Analyze sex, age at meningitis, vaccination, hospitalization duration, and petechiae characteristics.
- Determine prevalence and clinical-epidemiological links of orthopedic sequelae.
- Assess clinical aspects: age at illness, hospitalization time, type and diagnosis age of sequelae, and surgeries performed.
- Evaluate the link between number of surgeries and age at sequela diagnosis.



Method

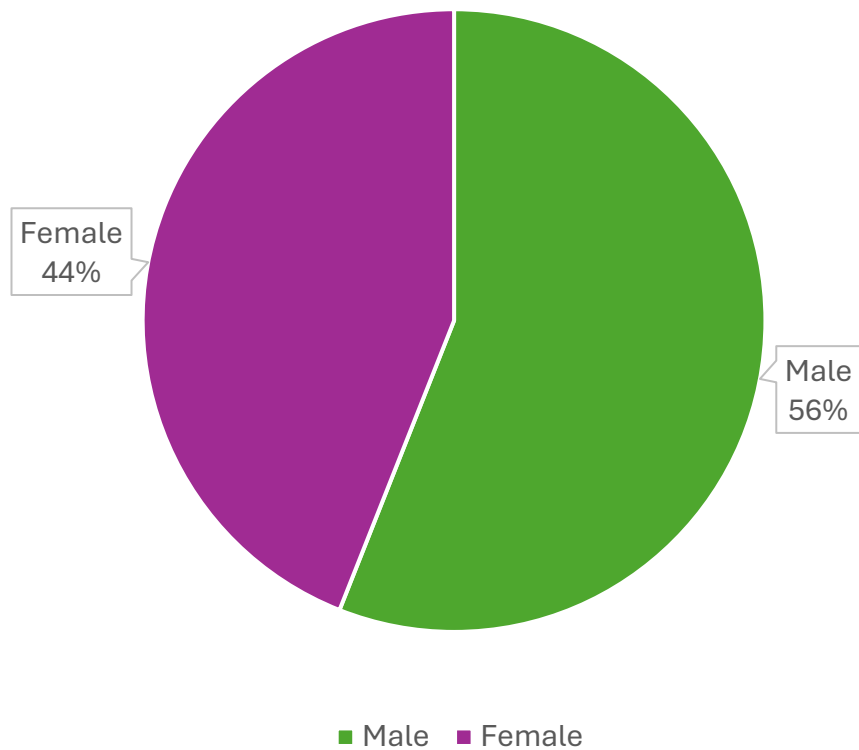
- **Design:** Cross-sectional, descriptive, retrospective observational study.
- **Location:** Joana de Gusmão Children's Hospital, Florianópolis-SC.
- **Population:** Patients diagnosed with bacterial meningitis from March 1994 to December 2012 (n=571).



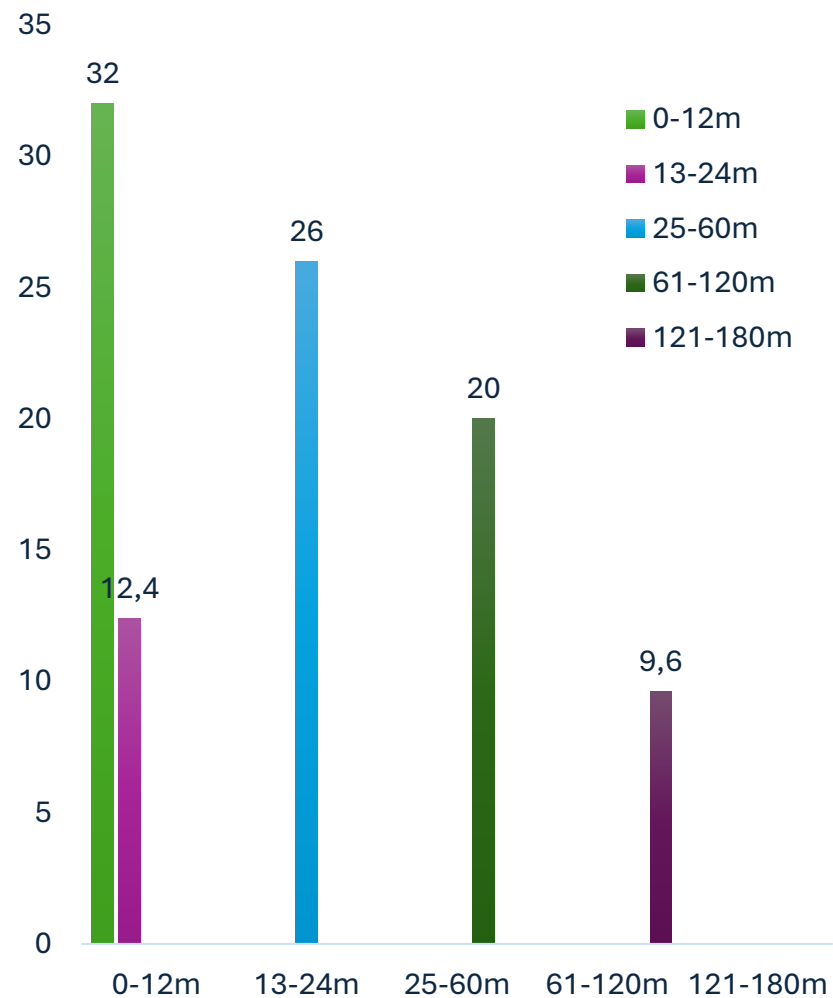


Results

Sex

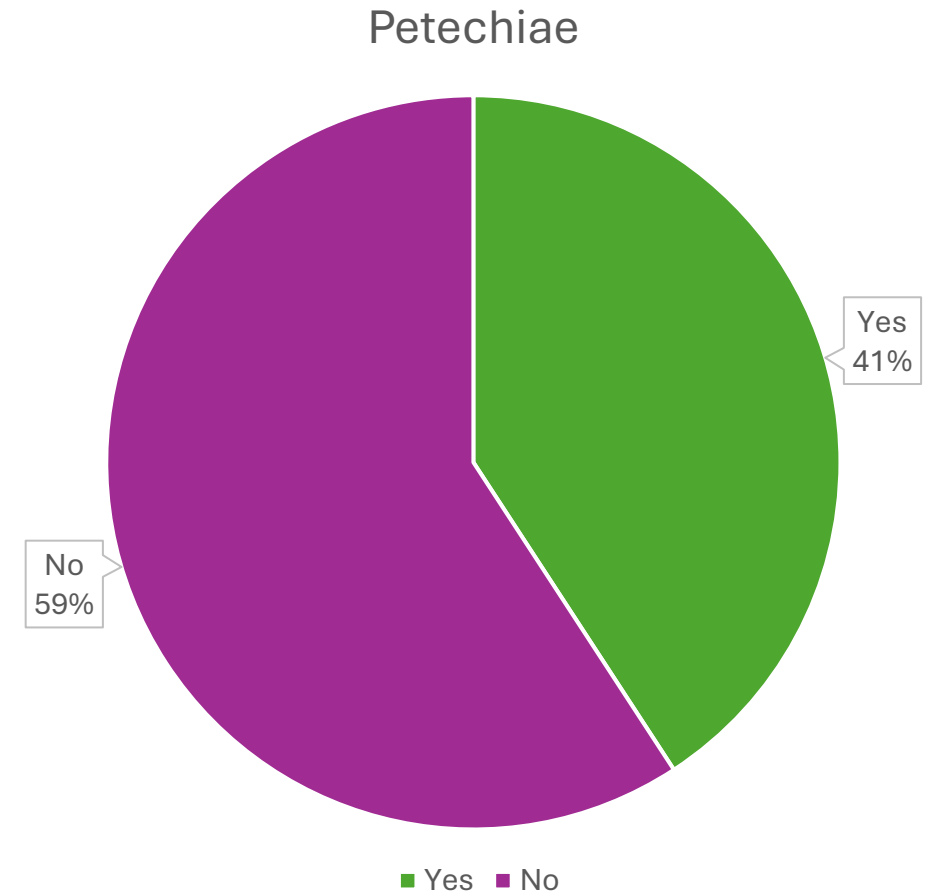
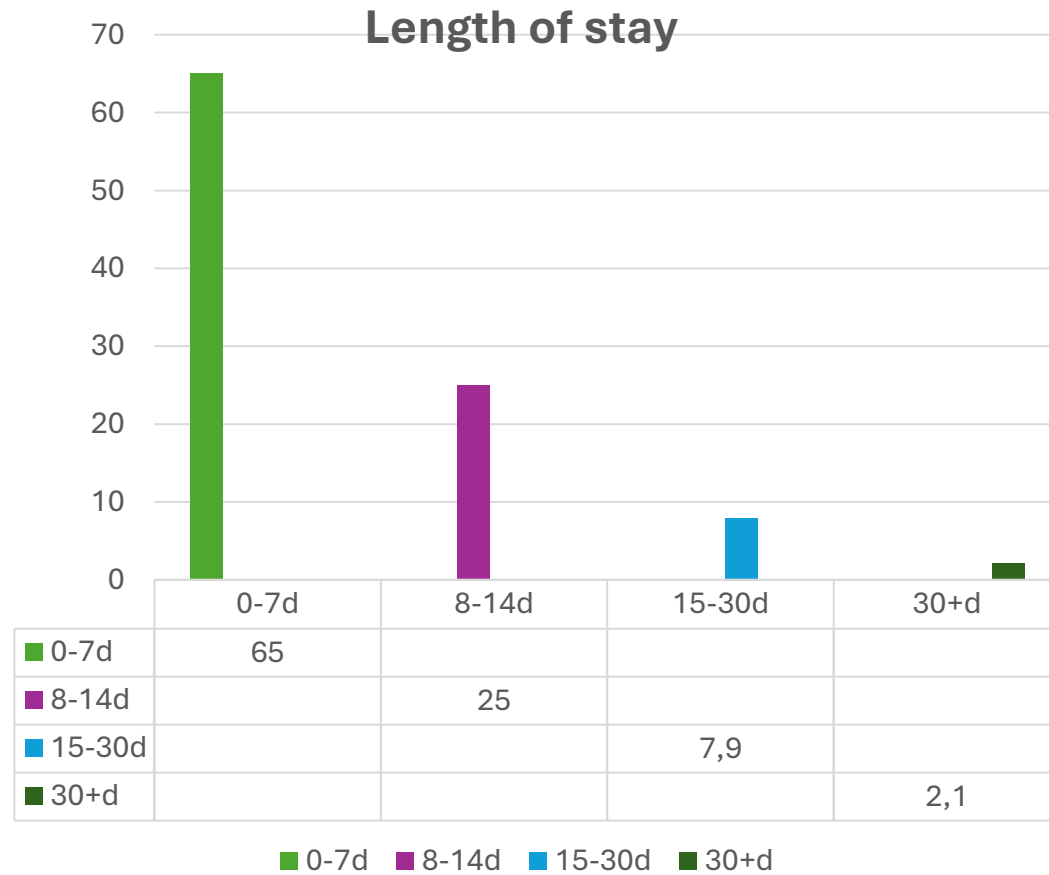


Age



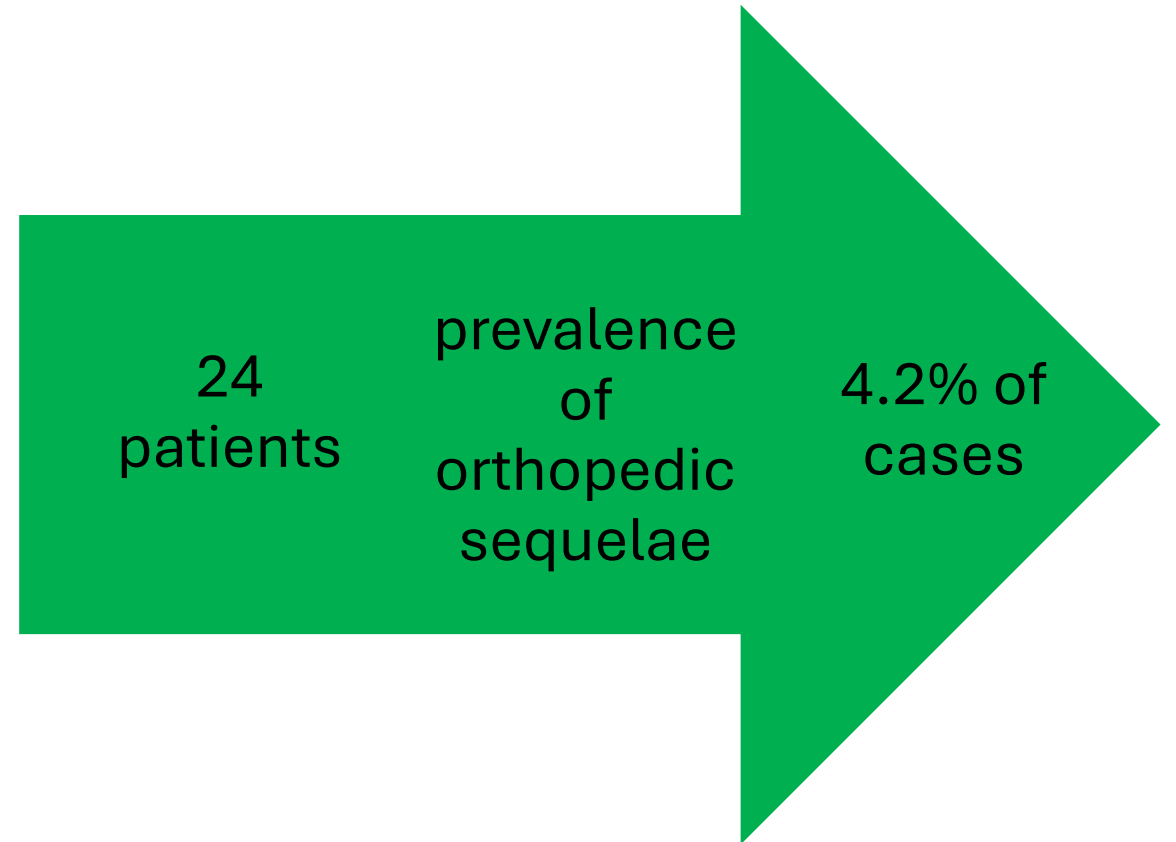
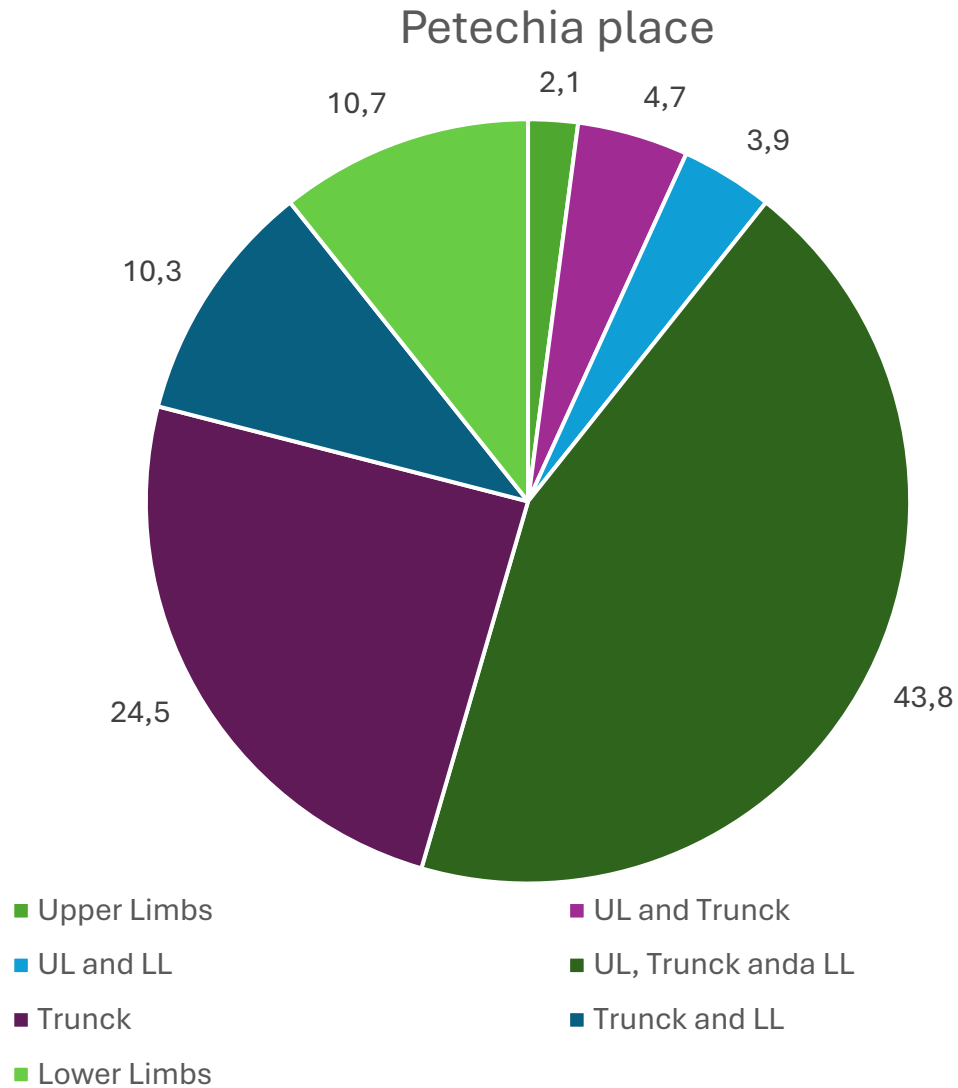


Results





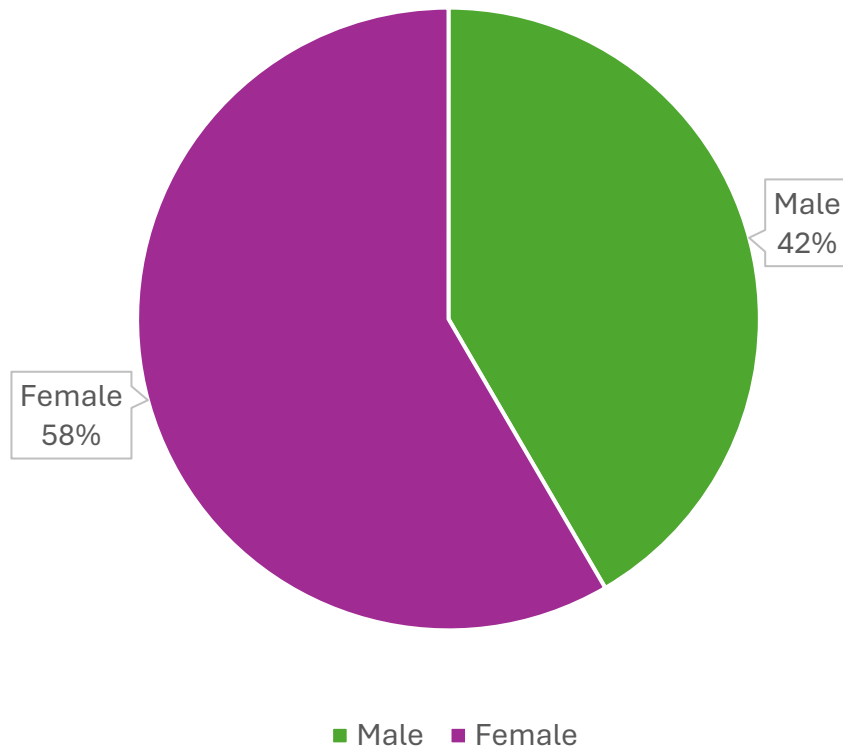
Results



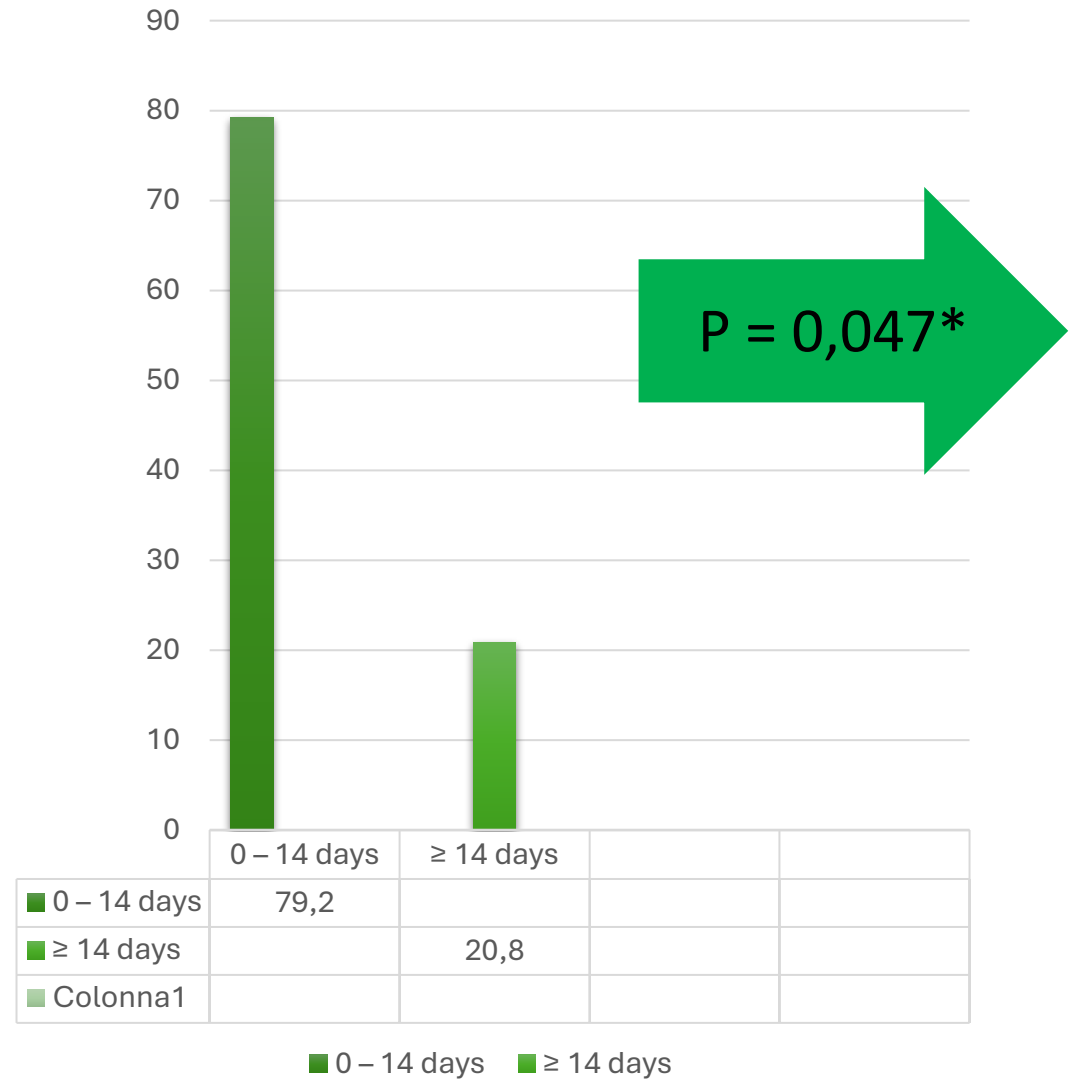


Results

Sex sequelae



Length of stay sequelae

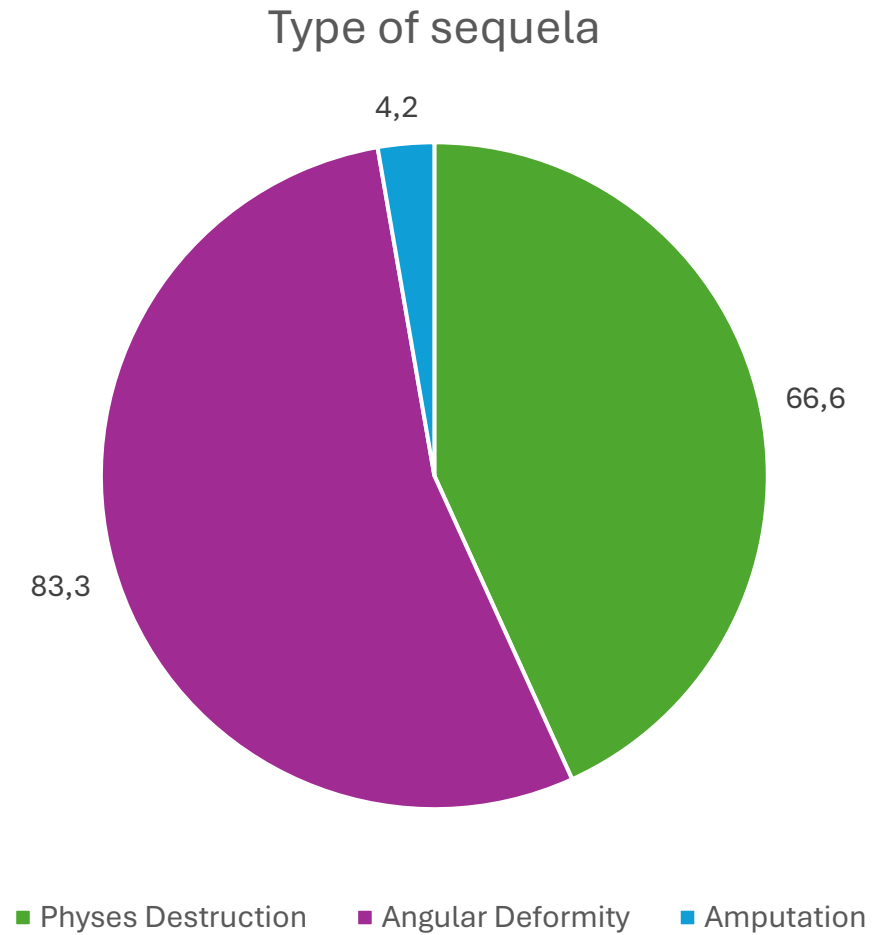




Results

Petequial place	YES	NO
Upper limbs	8,3	91,7
UL + Trunck + LL	25	75
Trunck	8,3	91,7
Trunck + LL	16,7	83,3
Lower Limbs	41,7	58,3

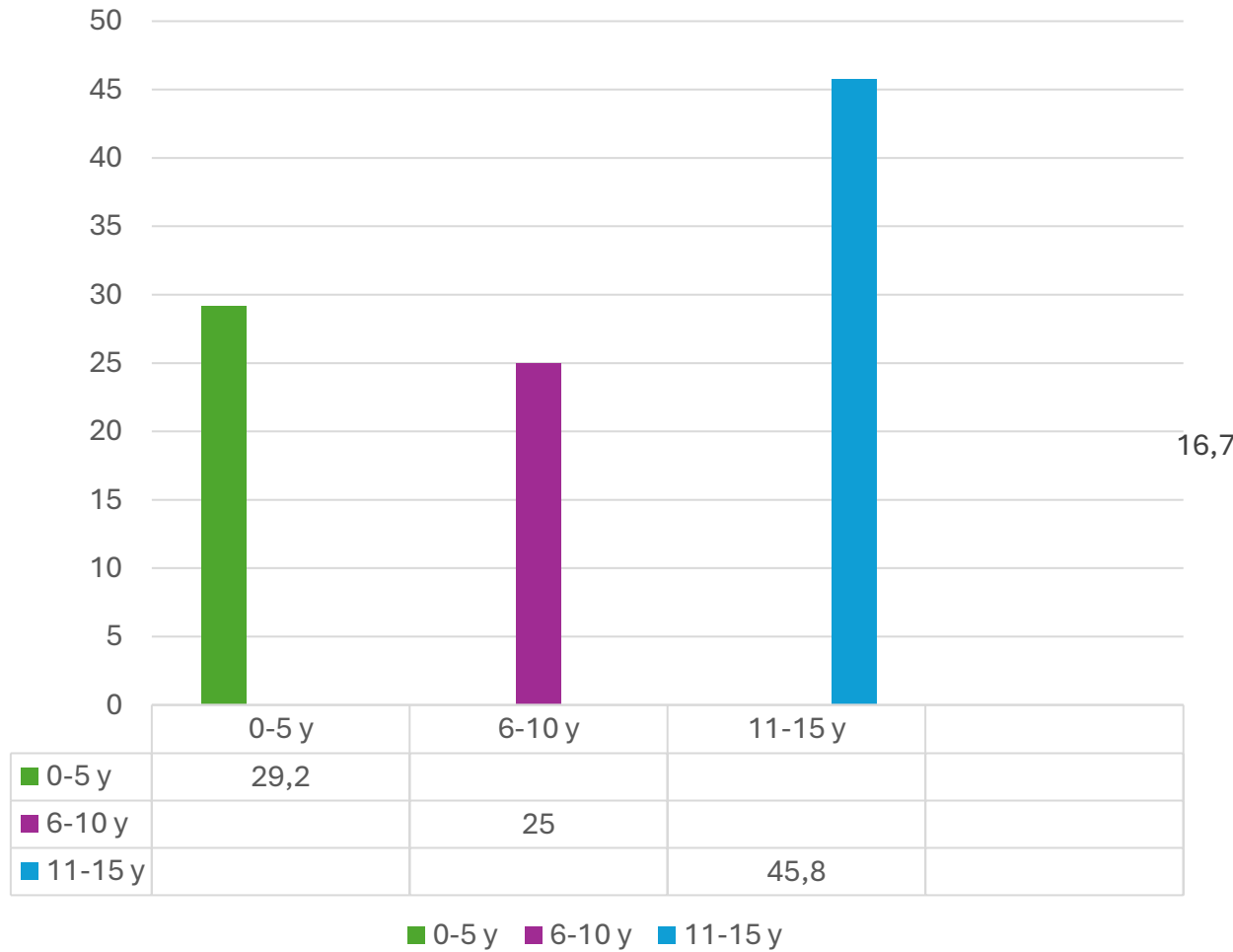
$P = 0,001^*$



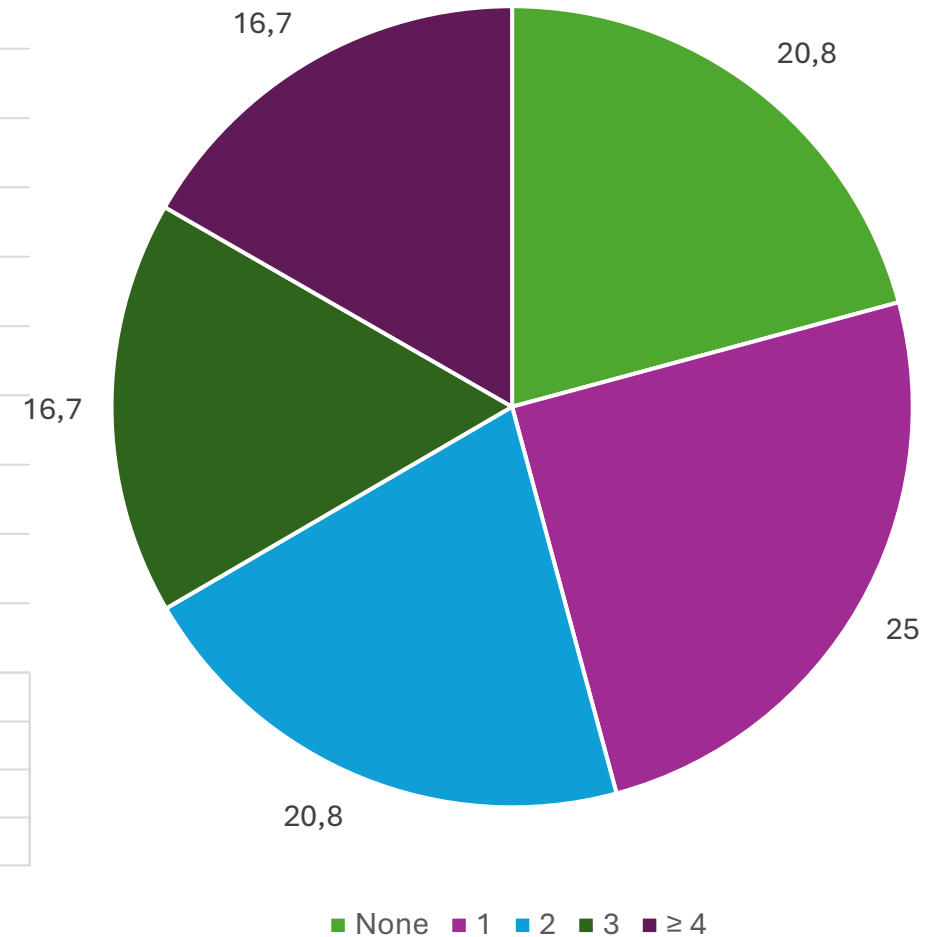


Results

Age diagnostic



Number of subsequent surgeries





Results

Variables	Age diagnostic 1 – 5 years	Age diagnóstico 6 – 10 years	Age diagnóstico 11 – 15 years
Numbers of surgery	n (%)	n (%)	n (%)
None	4 (57,1)	1 (16,7)	0 (0,0)
≥ 1	3 (42,9)	5 (83,3)	11 (100)
total	7 (100)	6 (100)	11 (100)

$P = 0,014^*$



Discussion

- 24 orthopedic sequelae cases over 18 years.
- Comparison:
 - Canavese: 48 cases in 31 years
 - Nectoux: 19 cases in 18 years. Equal incidence under 1 year and 5–10 years.
 - Park: 10 cases in 12 years
- Belthur: 54.2% male; Canavese & Park: 54% and 70% female
- Belthur: 45.8% under 1 year; 95.8% had physeal destruction.
 - Early orthopedic follow-up needed until skeletal maturity.



Discussion

Petechiae Location

- Buysse: 48% had petechiae; 86% in lower limbs.
- Vermunt: 52% in children, 50% in adolescents; lower limbs most affected.

Sequelae and Surgery

- Park: 50% angular deformity + physeal destruction; 80% had >1 surgery.
- Canavese: 44% amputations, 10% physeal destruction.
- Elrod: Angular deformities diagnosed from 5 months to 11 years post-infection.



Discussion

Diagnosis Timing

- Canavese: Average of 4.4 procedures; early diagnosis prevents complications.
- Nectoux:
 - Early diagnosis = fewer or simpler surgeries.
 - Late diagnosis = more surgeries.



Conclusion

Bacterial Meningitis Profile:

More common in males

Mostly affects children <1 year

Most were unvaccinated

Hospital stay: 0–7 days

Petechiae in fewer than half of cases; usually widespread

Conclusion

Orthopedic Sequelae Profile:

4.2% prevalence

Predominantly female

Age at meningitis: 5–10 years

Main type: Angular deformity

Diagnosis after age 11 was most frequent





Conclusion

Significant Associations:

Hospital stay duration during meningitis

Petechiae location

Age at diagnosis vs. number of surgeries



References

- Ramakrishnan M, Ulland A, Steinhardt L, Moisi J, Were F, Levine O. *Sequelae due to bacterial meningitis among African children: a systematic literature review*. BMC Medicine. 2009;7:47.
- World Health Organization. *Meningococcal meningitis*, November 2012. Accessed May 2014. Available at: <http://www.who.int/mediacentre/factsheets/fs141/en/>
- Rossi P, Mantovani J, Ferroni E, Forcina A, Stanghellini E, Curtale F, Borgia P. *Incidence of bacterial meningitis (2001–2005) in Lazio, Italy: results of an integrated surveillance system*. BMC Infectious Diseases. 2009;9:13.
- Jusot J, Tohon Z, Yazı A, Collard J. *Significant sequelae after bacterial meningitis in Niger: a cohort study*. BMC Infectious Diseases. 2013;13:228.
- Kavuncuoglu S, Gursoy S, Turel O, Aldemir E, Hosaf E. *Neonatal bacterial meningitis in Turkey: epidemiology, risk factors, and prognosis*. J Infect Dev Ctries. 2013;7(2):73–81.
- Brazilian Society of Pediatrics. *Immunization Schedule*. Department of Infectious Diseases. 2013. Accessed September 2014. Available at: http://www.sbp.com.br/pdfs/calendario_vacina_2013.pdf
- Harrison L. *The Epidemiology of Meningococcal Disease in the United States*. Clin Infect Dis. 2010;50:37.
- Mook-Kanamori B, Geldhoff M, Poll T, Beek D. *Pathogenesis and pathophysiology of pneumococcal meningitis*. Clin Microbiol Rev. 2011;24(3):557–91.
- Luksic I, Mulic R, Falconer R, Orban M, Sidhu S, Rudan I. *Estimating global and regional morbidity from acute bacterial meningitis in children: assessment of the evidence*. Croat Med J. 2013;54:510–8.
- Brazilian Ministry of Health. Department of Health Information Systems (DATASUS). *Hospitalizations and mortality rate by meningococcal infection*. 2020. Accessed November 2020. Available at: <http://tabnet.datasus.gov.br/cgi/defthtm.exe?sih/cnv/nisc.def>
- Jenson HB, Kliegman RM, Behrman RE. *Nelson Textbook of Pediatrics*. 19th ed. Rio de Janeiro: Elsevier; 2013. v.1: p.2161–70.
- Ausiello D. *Cecil Textbook of Medicine*. 23rd ed. Rio de Janeiro: Elsevier; 2009. v. 1: p.2548–53.
- Abbas AK, Kumar V, Mitchell RN. *Robbins and Cotran Pathologic Basis of Disease*. 8th ed. Rio de Janeiro: Elsevier; 2010. p.1307–8.
- Antoniuk S, Hamdar F, Ducci R, Kira A, Cat M, Cruz C. *Childhood acute bacterial meningitis: risk factors for acute neurological complications and sequelae*. J Pediatr (Rio J). 2011;87:535–40.
- de Jonge R, Furth A, Wassenaar M, Gemke R, Terwee C. *Predicting sequelae and death after bacterial meningitis in childhood: a systematic review of prognostic studies*. BMC Infect Dis. 2010;10:232.

References

- Appel M, Pauleto A, Cunha L. *Osteochondral sequelae of meningococemia: radiographic aspects*. J Pediatr Orthop. 2002;22:511–6.
- Nectoux E, Mezel A, Raux S, Fron D, Klein C, Herbaux B. *Meningococcal purpura fulminans in children II: Late orthopedic sequelae management*. J Child Orthop. 2010;4:409–16.
- Belthur M, Bradish C, Gibbons P. *Late orthopedic sequelae following meningococcal septicemia*. J Bone Joint Surg. 2005;87:236–40.
- Campbell W, Joshi M, Sileo D. *Osteonecrosis following meningococemia and DIC in an adult: case report and review*. Clin Infect Dis. 1997;24:452–5.
- Masson-Behar V, Jacquier H, Richette P, et al. *Arthritis secondary to meningococcal disease: a case series of 7 patients*. Medicine. 2017;96(29).
- Wick J, Krajbich I, Kelly S, deWees T. *Meningococemia: The Pediatric Orthopedic Sequelae*. AORN Journal. 2013;97(5).
- Vasilopoulou V, Karanika M, Theodoridou K, Katsioullis A, Theodoridou M. *Prognostic factors related to sequelae in childhood bacterial meningitis: data from a Greek registry*. BMC Infect Dis. 2011;11:214.
- Canavese F, Krajbich J, LaFleur B. *Orthopedic sequelae of childhood meningococemia: management and outcomes*. J Bone Joint Surg. 2010;92:2196–203.
- Park D, Bradish C. *Management of orthopedic sequelae of meningococcal septicemia: patients treated to skeletal maturity*. J Bone Joint Surg Br. 2011;93-B:984–9.
- Buysse C, Oranje A, Zuidema E. *Long-term skin scarring and orthopedic sequelae in survivors of meningococcal septic shock*. Arch Dis Child. 2009;94:381–6.
- Elrod J, Mannhard D, Mohr C, et al. *Plastic and orthopedic interventions and long-term sequelae in children with meningococcal septicemia: 40 years of experience at University Children's Hospital Zurich*. Eur J Pediatr Surg. 2018:939–48.
- Campéas A, Campéas. *Bacterial Meningitis*. Revista Prática Hospitalar. 2003;5:27.
- Vermunt L, Buysse C, Joosten K. *Self-esteem in children and adolescents after septic shock caused by Neisseria meningitidis: scars do matter*. J Adolesc Health. 2008;42:386–93.
- Lucena R. *Clinical and laboratory characteristics of bacterial meningitis in children*. Arq Neuro-Psiquiatr. 1996;54(4):571–6.
- Ministry of Health (Brazil), Camile Moraes and Meningitis Surveillance Group. *Epidemiological Profile of Meningitis in Brazil and the World*. Porto Alegre: Health Secretariat; 2015.
- Monsell E, McBride A, Barnes J, Kirubanandan R. *Angular deformity of the ankle with sparing of the distal fibula after meningococcal septicemia*. J Bone Joint Surg Br. 2011;93-B:1131–3.
- Brazilian Ministry of Health. *Epidemiological Surveillance Guide*. Brasília: Ministry of Health; 2005. p.541–69.
- Meningitis Research Foundation. *Meningococcal Meningitis and Septicaemia: Guidance Notes*. BMA. 2014.
- Monsell F. *The skeletal consequences of meningococcal septicaemia*. Arch Dis Child. 2012;97:539–54.
- Morris ME, Maijub JG, Walker SK, et al. *Postgraduate Medical Journal*. 2013;89:340–5.
- Faria S, Farhat C. *Bacterial meningitis: diagnosis and management*. J Pediatr (Rio J). 1999;75:46–56.



Grazie!