

Incidence and aetiology of Danish children with community-acquired pneumonia treated with chest tube drainage in 2022–2023 versus the previous three decades

An emergence of complicated pneumonia due to invasive group A *Streptococcus* (GAS) was reported in 2022–2023.¹ We aimed to explore the incidence and cause of complicated community-acquired pneumonia treated with chest tube drainage (CTD) in 2022–2023, compared with the preceding three decades.

We retrospectively enrolled all patients aged 0–17 years treated with CTD due to community-acquired pneumonia from 1993–1994 to 2022–2023 at Copenhagen University Hospital, Rigshospitalet, a tertiary referral centre for CTD in Eastern Denmark, the Faroe Islands and Greenland (2.6 million inhabitants). Data from 1993–1994 to 2009–2010 was partly published previously.² Patients were identified through diagnosis codes for pleural

effusion and pleural empyema. Clinical information and laboratory results were extracted from medical records. Patients with severe chronic diseases, such as malignancy and heart disease, were excluded. A microorganism was considered causative if identified in blood or pleural fluid by culture, 16S rRNA PCR, and/or multiplex PCR assays.³ Incidences were calculated per 100 000 inhabitants aged 0–17 years from week 21 to week 20 the following year.

A total of 176 children were included. In season 2022–2023, 26 children had CTD compared with a median of 5 (range 1–13) children yearly prior to 2022–2023. This corresponded to yearly incidences of 4.9 vs 0.9 (range 0.2–2.5) per 100 000 children (RR 5.0; 95% CI 3.3 to 7.6; $p < 0.001$; Pearson's χ^2 test) (figure 1). GAS caused 19 of 26 (73%) cases in 2022–2023, in contrast to 16 of 66 (24%) cases with confirmed aetiology in the preceding decades ($p < 0.001$; Pearson's χ^2 test) (figure 1). In 2022–2023, viral co-infections, including varicella, influenza and human metapneumovirus, were identified in 14 of 20 (70%) cases with GAS. The median duration of hospital admission in cases with GAS was 12 days (IQR: 8–16)

in 2022–2023 vs 17 days (IQR: 13–21) prior to 2022–2023 ($p = 0.144$; Wilcoxon rank-sum test).

In this population-based cohort study, we found a fivefold increase in community-acquired pneumonia treated with CTD in 2022–2023, primarily due to increased GAS. This increase possibly reflected a high circulation of GAS in a susceptible population following COVID-19 mitigation measures.¹ In addition, a resurgence of viral infections predisposing to bacterial pneumonia in 2022–2023, for example, influenza and varicella, may have influenced the high incidence. We did not observe an increased severity of GAS cases during 2022–2023, based on the duration of hospital admission. Consistently, the mortality rate of invasive GAS disease in children was not higher in Denmark in 2022–2023, and the invasive GAS strains were estimated to have similar virulence.⁴

Limitations include the small population and the high proportion of unknown aetiologies before routine investigation with multiplex PCR on pleural fluid was implemented. The strengths were the population-based design, the long study period and the detailed registration of Danish patients.

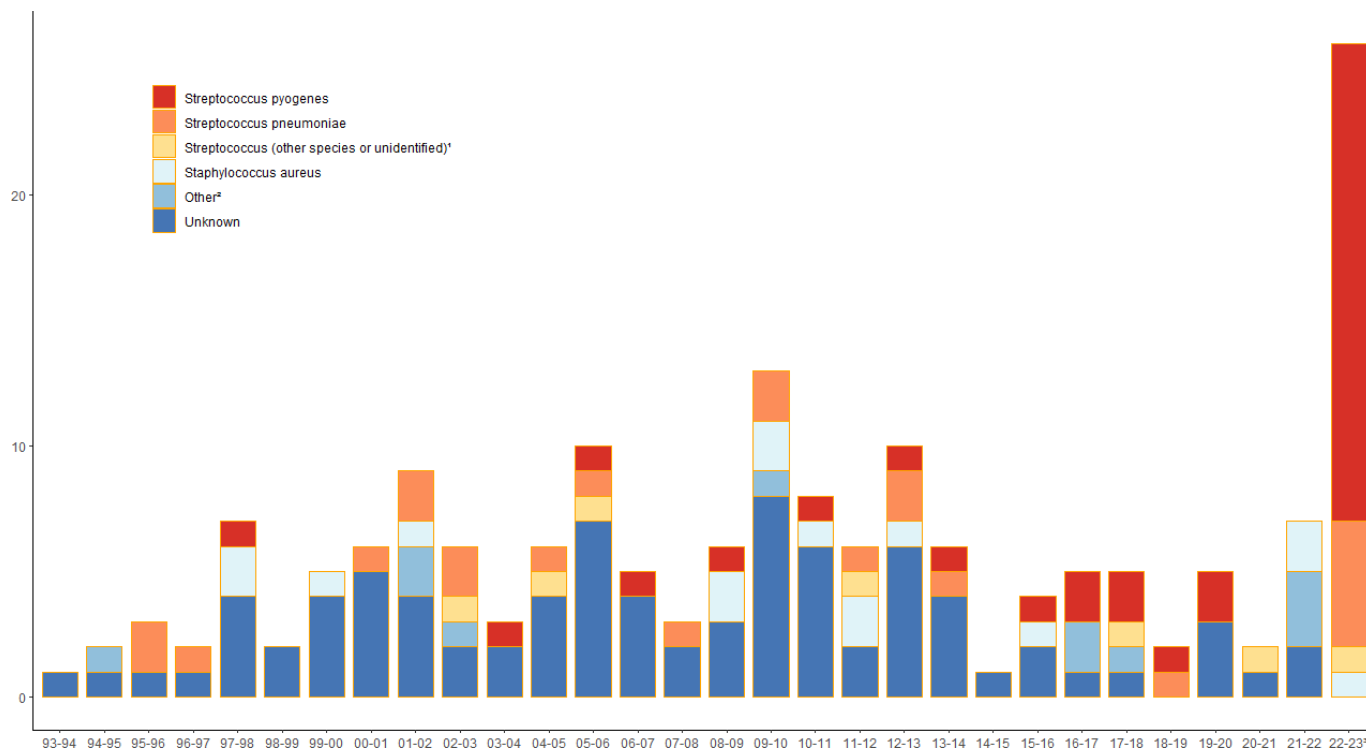


Figure 1 Incidence and aetiology of children with community-acquired pneumonia treated with chest tube drainage in 2022–2023 and the previous three decades.¹Streptococcus (other species or unidentified)* included *Streptococcus anginosus* (n=3), *Streptococcus intermedius* (n=1) and unidentified species (n=3).²Other† included *Fusobacterium* (n=3), *Haemophilus influenzae* (n=3), *Mycoplasma pneumoniae* (n=1), adenovirus (proven by PCR in blood and pleural fluid) (n=1) and *Mycobacterium tuberculosis* (n=3).³From 2022, all pleural fluid samples were investigated with PCR-based methods³, in addition to cultures, in contrast to 39% in 2013–2022 and none before 2012. In 2022–2023, 16 of 26 (62%) were treated with fibrinolytic therapy compared with 101 of 150 (67%) during the previous years ($p = 0.563$; Pearson's χ^2 test).

In conclusion, we found a fivefold increase in children with complicated community-acquired pneumonia treated with CTD in 2022–2023 versus the previous three decades, primarily due to GAS. For the individual child, GAS pneumonia treated with CTD did not seem to be more severe during 2022–2023.

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Contributors UN, AP and NHV conceptualised this study. UN obtained funding for the study. All coauthors were responsible for preliminary data analysis. UN, JB, CV and KHSD had full access to all of the data in the study. UN and JB verified the data and take responsibility for the integrity of the data and accuracy of the data analysis. UN, KK and NHV drafted the first version of the manuscript. All coauthors contributed to

the data interpretation, revised the manuscript critically for important intellectual content and finally approved the work. UN was responsible for the decision to submit the manuscript.

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Competing interests None declared.

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REFERENCES

- Bamford A, Whittaker E. Resurgence of group A streptococcal disease in children. *BMJ* 2023;380:43.
- Yu D, Buchvald F, Brandt B, *et al.* Seventeen-year study shows rise in parapneumonic effusion and empyema with higher treatment failure after chest tube drainage. *Acta Paediatr* 2014;103:93–9.
- Nygaard U, Kirkby NS, Bloch J, *et al.* Parapneumonic effusion in children: rapid pathogen detection in pleural fluid using multiplex bacterial PCR. *Acta Paediatr* 2023;112:1555–7.
- Johannesen TB, Munkstrup C, Edslev SM, *et al.* Increase in invasive group A streptococcal infections and emergence of novel, rapidly expanding sub-lineage of the virulent streptococcus pyogenes M1 clone. *Euro Surveill* 2023;28:2300291.