

Effects of DNase on Ventilated Asthmatic Children

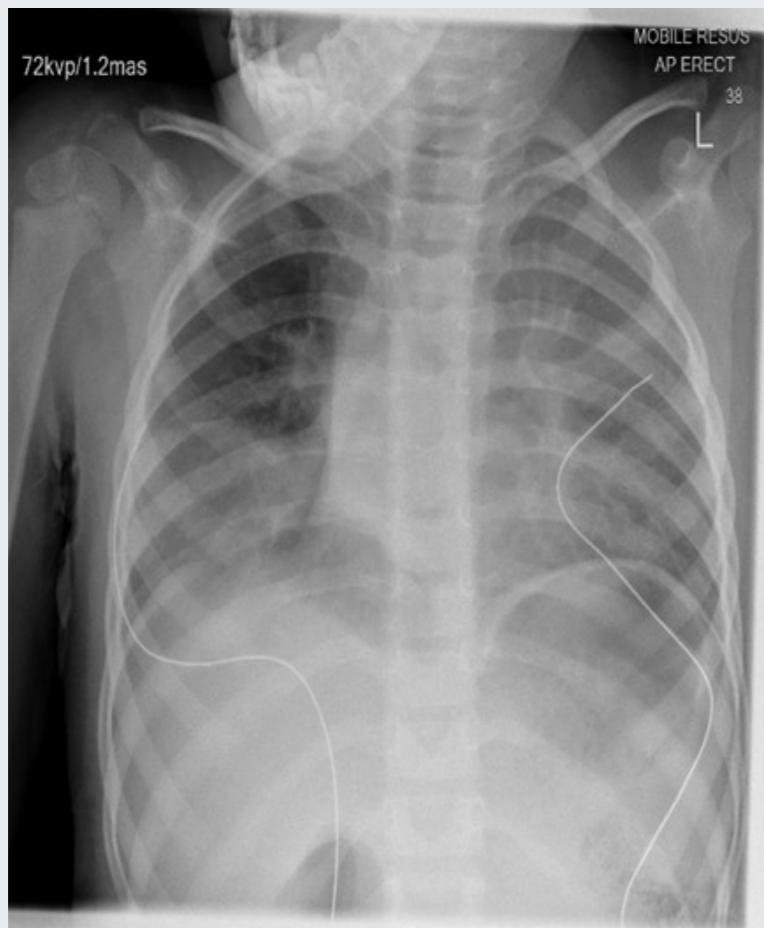
- Asthma affects 1:11 children in the UK (2)
- Children with life threatening Asthma may require admission into intensive care
- 40% of children who are admitted into intensive care are mechanically ventilated (5)

What is DNase (Dornase Alpha)?

It works by breaking down the DNA strands therefore reducing mucus viscosity and adhesiveness, making mucus thinner and easier to cough and clear (3).

Case Study:

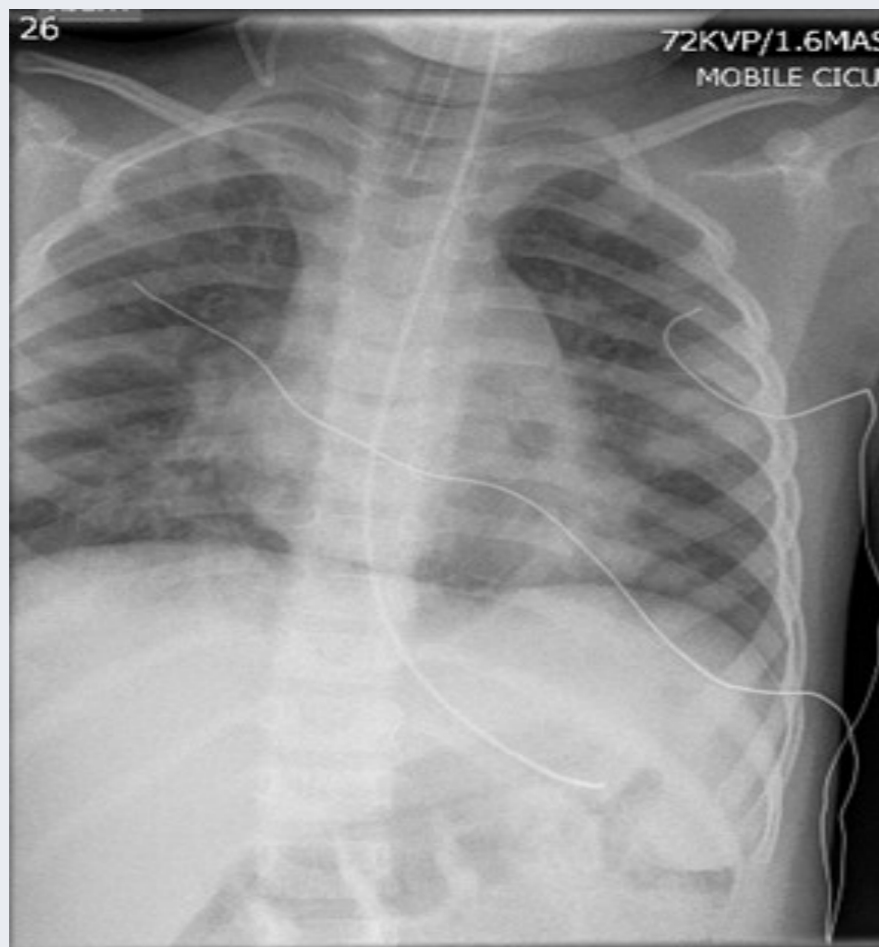
- 2 year old girl
- Presented to A&E with difficulty in breathing and wheeze
- X-ray showed right and left lower lobe collapse
- Became tachycardiac and had worsening wheeze therefore was intubated in A&E
- Asthma managed by GP prior to admission



Examination post treatment:

- Tidal volumes increased 125mls to 152mls
- Minute Volume increase to 4.8 from 3.4
- Pressure Control reduced to 15 from 17
- FiO2 weaned to 0.40 1 hour post physiotherapy
- ABG: pH 7.517 PaCO2 4 PaO2 10.4 HC03 26.2 BE 2
- Improved right and left lower lobe collapse

X-Ray below



Conclusion

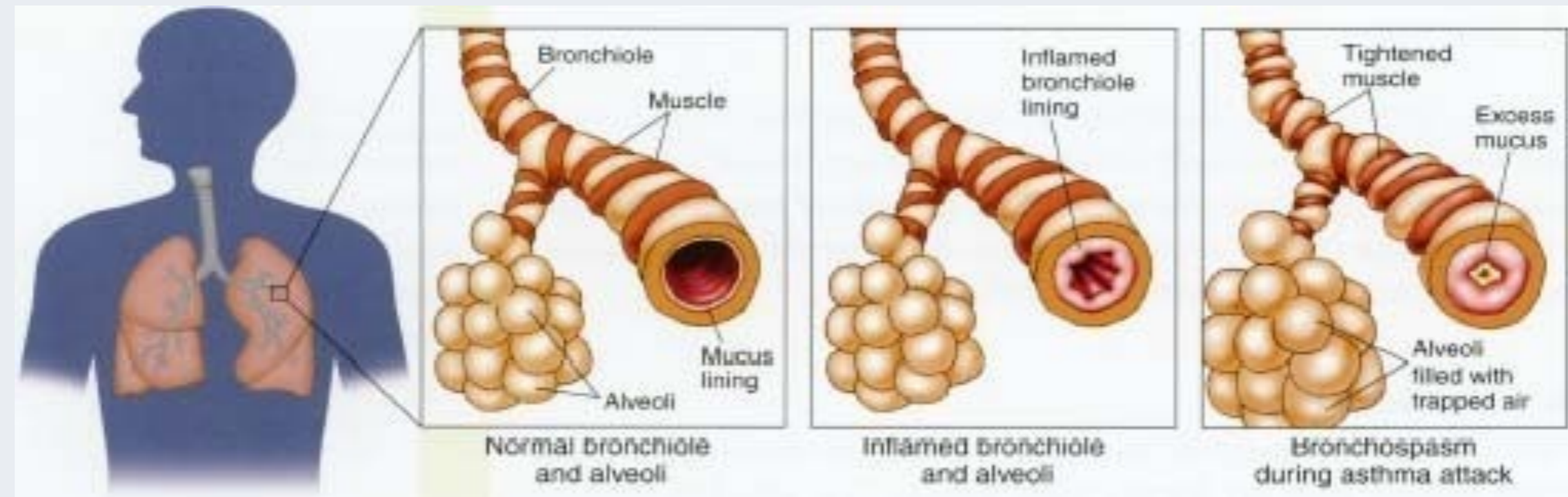
Following the instillation of DNase within this patient, there was a significant improvement in ventilation and blood gasses. This then meant that this patient was able to be extubated the following day. This dramatic improvement seems to be related to both DNase instillation and physiotherapy treatment.

In summary, there is little research into the effectiveness of DNase in the management of ventilated asthma patients and therefore further exploration into this area is needed. However, the small number of case studies available have shown that the use of DNase has dramatic reversal on airway obstruction in ventilated asthmatic children, thus improving outcomes for children who are mechanically ventilated. This has been demonstrated in this case study.

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- One of the causes off these children being mechanically ventilated is due to severe mucus plugging. Which can cause airflow obstruction in this patient group (1).
- Airflow obstruction is caused by the narrowing of airways secondary to inflammation of airways which can lead to the trapping of secretions (1), as seen in diagram below.



Examination pre treatment:

Ventilator settings: PSIMV fI02.30 Ventilator Rate 25 RR 25 PIP 22 PEEP 7 Spo2 100% Pressure Support 12 Pressure Control 17 Tidal Volumes 125mls Minute Volume 3.4

Observations: Spo2 100% HR 141 BP 109/66

ABG: pH 7.4 PaCo2 6.06 PaO2 7.32 HC03 26.9 BE 3.1

Infusions: Morphine, Midazolam

Medicines: 7% sodium chloride neb as required/ PRN

Auscultation: Reduced air entry throughout, some crackles throughout

Virology and Microbiology Swabs negative

Bloods: CRP 94

X-Ray to the left

Physiotherapy Intervention

Day 1 Treatment: 3% hypotonic nebuliser, manual inflation, manual techniques, positioning and suctioning

Patient became unstable (tachycardia and fluctuating saturations) and had increased expiratory polyphonic wheeze therefore treatment stopped.

Day 2: Discussion with consultant about trialling the use of instilling DNase.

- Patient adequately sedated and muscle relaxant used
- 2.5mls DNase instilled via ET with size 8 NG tube in right and left side lying and then in supine in high sitting
- Ventilator settings adjusted by consultant: vent rate increased to 30, PIP increased to 25, FiO2 increased to 80
- Left for 1 hour
- Further physiotherapy treatment carried out 1 hour later. Consisting of 0.9% saline neb, manual inflation, manual techniques in alternative side lying and suctioning.
- Large volumes of thick yellow secretions cleared and the patient was returned to the ventilator post treatment.

DNase were only used once

Outcome

- The patient was extubated the next morning after minimal suctioning overnight and transferred to the ward that afternoon
- They did not require any further chest physiotherapy input post DNase treatment
- Physiotherapy was needed to regain mobility
- Asthma follow up was provided by the consultant

Discussion

Does instilling DNase into ventilated asthma patients help to reduce ventilation days and therefore ITU length of stay?

- There were no randomised control trials that addressed the above clinical question.
- Durward (2000) published a case report about a 7 year old boy who was admitted with status asthma and severe respiratory failure. They used standard physiotherapy techniques to aid chest clearance. However they did find that instilling DNase via NG cleared large volumes of secretions therefore improving patients left lower lobe collapse. The patient was extubated 26 hours later (3).
- A further case study report by Patel (2000) discussed the use of instilling DNase on a 3 year old ventilated child. They instilled DNase using the same method as in our case study and then 30 minutes later carried out conventional physiotherapy treatments. This case study also showed dramatic changes in ventilation allowing a drop in PAP and an increase in tidal volumes. The patient was extubated 72 hours after DNase (6)
- Both the above two case studies have demonstrated that instilling DNase can have a positive effect on patients who have been ventilated due to severe asthma.
- However there is very little research available currently.

Learning Points:

- Consider the use of DNase in ventilated asthmatic children in early stages of intubation if conventional therapy is not successful
- Continue to gather information about asthmatic children who are ventilated as they are admitted to CICU
- Develop a protocol for DNase instillation in severe mucus plugging

References

1. "Why Asthma still kills, The national review of Asthma deaths" Confidential enquiry report May 2014 Royal College of Physicians. M.Levy, R. Andrews
2. <https://www.blf.org.uk/support-for-you/asthma-in-children/what-is-it>
3. Resolution of mucus plugging and atelectasis after intratracheal rhDNase therapy in a mechanically ventilated child with refractory status asthmatics Andrew Durward, MBChB, FCP; Vito Forte, MD; Sam D. Shemie, MD, CM From the Department of Critical Care Medicine (Drs. Durward, Shemie) and the Department of Otolaryngology (Dr. Forte), The Hospital for Sick Children, University of Toronto. 2000
4. Case Studies in Paediatric Critical Care Edited by Peter J. Murphy Stephen C. Marriage Peter J. Davis
5. Mucolytic for Intubated Asthmatic Children: A National Survey of United Kingdom Paediatric Intensive Care Consultants Aarjan Peter Snoek1 and Joe Brierley2 1Department of Anaesthesia, Great Ormond Street Hospital for Children NHS Foundation Trust, Great Ormond Street, London WC1N 3JH, UK 2Department of Paediatric Intensive Care, Great Ormond Street Hospital for Children NHS Foundation Trust, Great Ormond Street, London WC1N 3JH, UK Correspondence should be addressed to Aarjan Peter Snoek; snoek@doctors.net.uk Received 30 October 2014; Accepted 23 January 2013
6. Intratracheal recombinant human deoxyribonuclease in acute life-threatening asthma refractory to conventional treatment. A. Patel, E. Harrison, A. Durwood and I.A. Murdoch British Journal of anaesthesia 84 (4) 505-507 2000