

# Morbidity and mortality in children with low muscle mass undergoing scoliosis surgery - A retrospective cohort study

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## Background

Children with low muscle mass are at increased risk of pulmonary, circulatory, nutritional and surgical complications. Many of these children suffer from malnutrition and underweight, and rely on respiratory and nutritional support. Furthermore, many have to undergo surgery for scoliosis. The knowledge about the rate and severity of complications to scoliosis surgery is scarce in this patient group.

We aimed to assess morbidity and mortality in children with low muscle mass undergoing spinal surgery within a five year period.

## Methods

### Design

Retrospective, single-centre cohort study.

### Participants – inclusion criteria

- Age ≤ 18 years
- Scoliosis surgery
- One of the following diagnoses:
  - Spinal muscular atrophy type II or III (SMA II, SMA III)
  - Cerebral palsy (CP)
  - Duchenne muscular dystrophy (DMD)
  - Ullrich muscular dystrophy (Ullrich)
  - Merosin-deficient congenital muscular dystrophy (MDC1A)

### Data extraction and handling

We included consecutive patients undergoing scoliosis surgery at Copenhagen University Hospital, Rigshospitalet between November 2011 – November 2016. We registered predefined pre-, intra, and postoperative variables from the medical files.

### Primary outcome measure:

- 90 days mortality

### Secondary outcome measures:

- Duration of mechanical ventilation
- Days in the intensive care unit (ICU)
- Number of red blood cell transfusions
- Rate of pneumonia
- Rate of bacteraemia
- Renal replacement therapy
- Rate of hypoglycemia or hyperglycemia
- Re-operative surgery rates
- Hospital length of stay
- Readmission rates

Demographics:		All (n=48)
Patients, n		48
Age (years), median (IQR)		14 (13-15)
Sex (gender), n		24 M / 24 F
BMI (kg/m <sup>2</sup> ), median (IQR)	n=47	17.7 (14.7-20.3)
Wheelchair bound, n	n=47	46
Diagnosis, n	SMA II	8
	SMA III	2
	CP	28
	DMD	6
	MDC1A	2
	Ullrich	2
	Respiratory assistance, n	n=47
Home-ventilator		2
Night BiPAP		10
Cough machine		12
Intermittent CPAP		19
No respiratory assistance	23	
Nutrition, n	n=47	
	Full oral diet	27
	Oral diet + enteral nutrition via nasogastric tube	1
	Oral diet + enteral nutrition via PEG tube	10
	Enteral nutrition via PEG tube	9

n = number, BiPAP = Bi-level positive airways pressure, CPAP = Continuous Positive Airway Pressure

## Results

### Preoperatively (Table 1 and 2):

- 40 % had their nutritional status assessed
- 43 % received supplemental nutrition by either PEG or nasogastric tube
- 51 % received respiratory assistance, varying from couch machine, CPAP to ventilator.

Preoperative variables:		All (n=48)
Nutritional screening, n (%)	n=47	19 (39.6)
Dexascan, n (%)	n=47	11 (23.3)
Monitoring at respiratory centre, n (%)	n=46	22 (45.8)
Baclofen, n (%)	n=46	14 (29.2)

Intraoperative variables:		All (n=48)
Duration of surgery (hours), median (IQR)		4.0 (3.3-5.1)
Blood loss (liters), median (IQR)	n=45	1.2 (0.9-2.1)
Extubation in OR, n (%)	n=46	8 (16.7)

Table 2- preoperative and intraoperative variables

### Outcomes (Table 3):

- The median (IQR) days in the ICU was 11 (3-23) days in the group that developed pneumonia versus 1 (1-2) day in the group that did not, p = 0.001.
- The median (IQR) duration of mechanical ventilation in the ICU was 10.0 (0.8-35.0) days in the group that developed pneumonia versus 0.0(0.0-0.8) days in the group that did not, p = 0.002.
- The median (IQR) hospital length of stay in days was 27 (11-50) days in the group that developed pneumonia versus 11 (10-14) in the group that did not, p = 0.029.

Outcomes:		All (n=48)
90 days mortality rate, n		0
Duration of mechanical ventilation in ICU (days), median (IQR)	n= 46	0 (0-1)
Renal replacement therapy, n		0
Number of red blood cell transfusions in ICU, median (IQR)		1.0 (1.0-1.3)
Pneumonia, n (%)		6 (12.5)
Bacteraemia, n (%)		1 (2.1)
Hyperglycaemia, n (%)		-
Hypoglycaemia, n (%)		-
Days in ICU, median (IQR)		1.0 (1.0-2.8)
Hospital length of stay (days), median (IQR)	n=47	11 (10-15)
Re-operative surgery, n (%)		1 (2.1)
Readmitted to hospital, n (%)	n=47	6 (12.5)

Table 3 – Primary and secondary outcomes

## Conclusion

Morbidity in children with low muscle mass undergoing scoliosis surgery is high, including risk of serious pulmonary complications. Furthermore, a high percentage of children are not screened for nutrition, respiratory problems or bone mineralization. Implementation of a perioperative care protocol may decrease morbidity in this vulnerable patient group and increase quality of care.

