Oxygen reduction test

Bronchopulmonary dysplasia (BPD) can be classified in to mild, moderate or severe depending on the amount and duration of supplemental oxygen and the level of respiratory support. If a patient has received supplemental oxygen for more than 28 d (FiO_2 > 0.21 for more than 12 hours each day) and is receiving no extra oxygen at 36 weeks postmenstrual age (PMA), he or she is classified as having mild BPD. If the oxygen need at 36 weeks PMA is between 0.21 and 0.30 using a flow of 1 L/min, or when "low flow" (< 1 L/min) is used with a FiO_2 > 0.21, BPD is classified as moderate (depending on the oxygen reduction test, see below). In case of a FiO_2 > 0.30 at 1 L/min flow or a flow > 1 L/min (independent of the FiO_2) or receiving continuous positive airway pressure (nCPAP)/mechanical ventilation BPD is classified as severe.

It is important to realize that the duration of supplemental oxygen is highly dependent on target ranges of transcutaneous oxygen saturation (SpO_2) and the alertness of the clinician to actively wean oxygen delivery.

To make sure that patients receive supplemental oxygen for pulmonary reasons and to standardize the amount of oxygen to predefined and uniform SpO_2 targets, Walsh et al. developed a so-called oxygen reduction test at 36 weeks PMA. Patients are eligible for testing if they need a FiO_2 between 0.21 and 0.30 using a flow of 1 L/min, or "low flow" (< 1 L/min) with a FiO_2 > 0.21 to maintain the SpO_2 between 90-96% or.with respiratory support > 0.30, but the SpO2 is > 96%. The oxygen reduction test should not be applied to patients supported with nasal cannulae (flow ≤ 1 L/min) without supplemental oxygen

(mild BPD), or patients treated with a flow of 1 L/min + FiO_2 > 0.30/ high-flow (> 1 L/min) nasal cannula (HFNC)/nCPAP/mechanical ventilation (severe BPD).

The oxygen reduction test

Indications:

- FiO_2 > 0.21 and < 0.30 with 1 L/min flow with oxygen saturation ranges between 90% and 96%
- FiO_2 > 0.30 with flow 1 L/min and an oxygen saturation range above 96%
- flow < 1 L/min with FiO_2 > 0.21 and an oxygen saturation range above 90%

Methods:

The patient is placed in supine position and the test is initiated 30 minutes after a feeding. The supplemental oxygen requirement will be gradually weaned to room air while monitoring SpO_2. The diagnosis moderate BPD can be rejected when the SpO_2 remain above ≥ 88% in room air during 1 hour without an clinical significant increase of (stimulated) apnea or bradycardia compared to before initiating the test.

The diagnosis moderate BPD is confirmed if the saturation goes below 80% during a consecutive period of > 1 minute or remains between 80-87% during a consecutive period of > 5 minutes. All occurrences of movement artefact (defined as visible motion of the infant together with loss of plethysmograph signal from the monitor) are recorded and corresponding saturation values are to be ignored.

The test contains 4 phases

Phase 1: Baseline evaluation

For 15 minutes heart rate, respiratory rate, SpO_2, number of apnea (cessation of breathing > 20 seconds) and bradycardia (hartrate < 80/min during > 10 sec) will be collected.

Phase 2: Oxygen reduction

Two situations can occur with a slightly different approach:

1. In case the patient is supported with nasal cannulae with 1 L/min flow, the supplemental oxygen will be weaned by 2% every 10 minutes to room air. In this case the cannulae **can be left in place** and the observation period will begin.
2. In case a "low-flow" support is provided to the patient (variable flow < 1 L/min with FiO_2 > 0.21) the flow will be weaned with 0.1 L/min every 10 minutes to 0 L/min keeping the supplemental oxygen the same; In this case the nasal cannulae **will be removed** from the nares, but not removed from the face.

In case during the reduction period a desaturation below 80% occurs for a consecutive period of > 1 minute or saturation between 80-87% for a consecutive period of > 5 minutes, the supplemental oxygen will be restarted and the test will be aborted.

Phase 3: Observation period

For the period of 1 hour the heart rate, respiratory rate, and SpO_2 in room air will be registered. In case of a desaturation below 80% for a consecutive

period of > 1 minute or saturation between 80-87% for a consecutive period of > 5 minutes, the supplemental oxygen will be restarted and the test will be aborted.

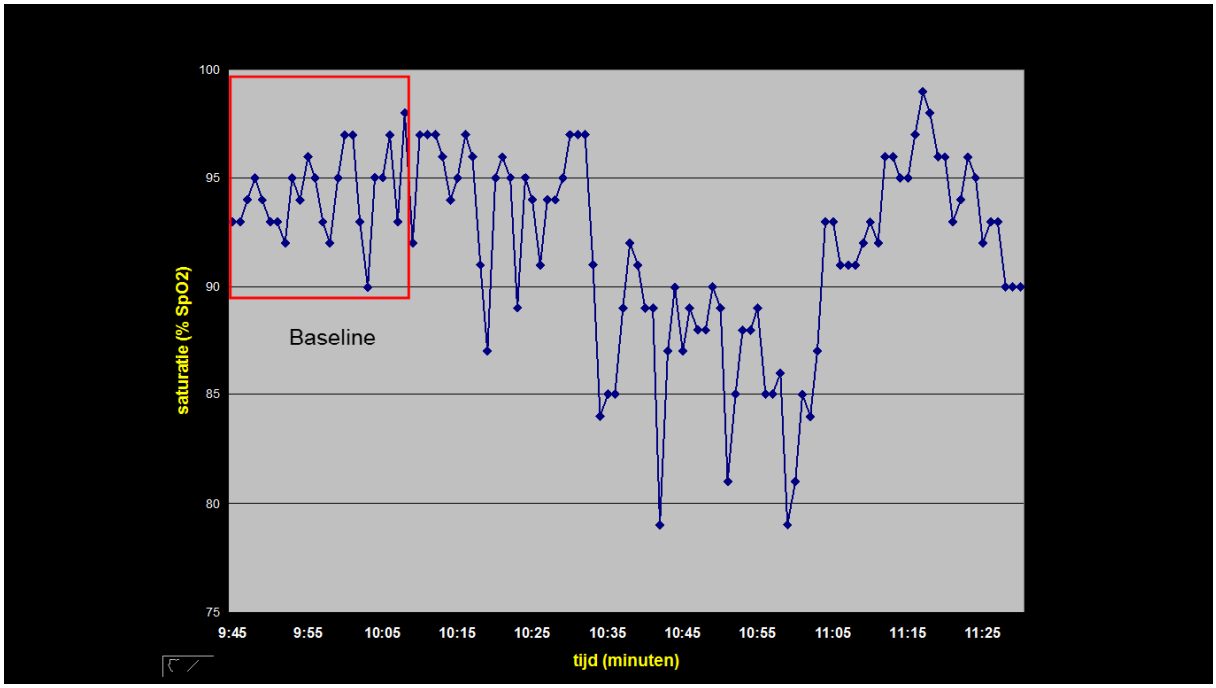
Phase 4: Back to situation before the test

The level of supplemental oxygen and flow will be reset to the status before the test.

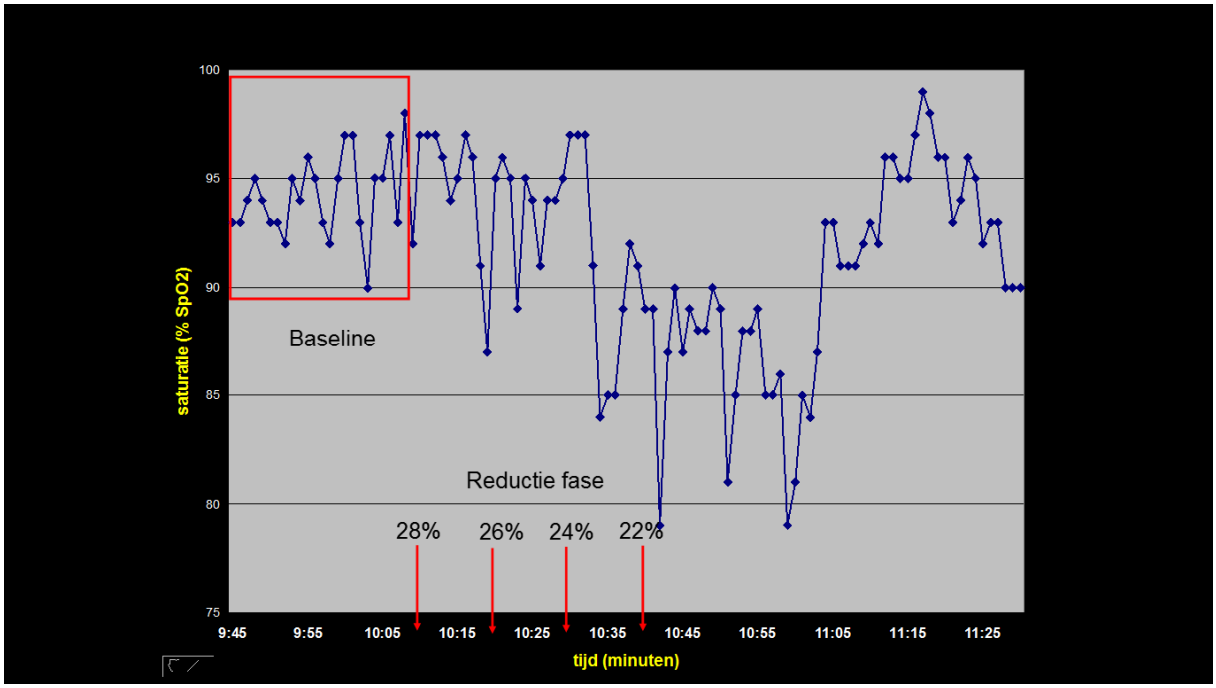
Two examples of the oxygen reduction test

Patient 1: CGA 36 weeks with nasal cannulae 30% supplemental oxygen

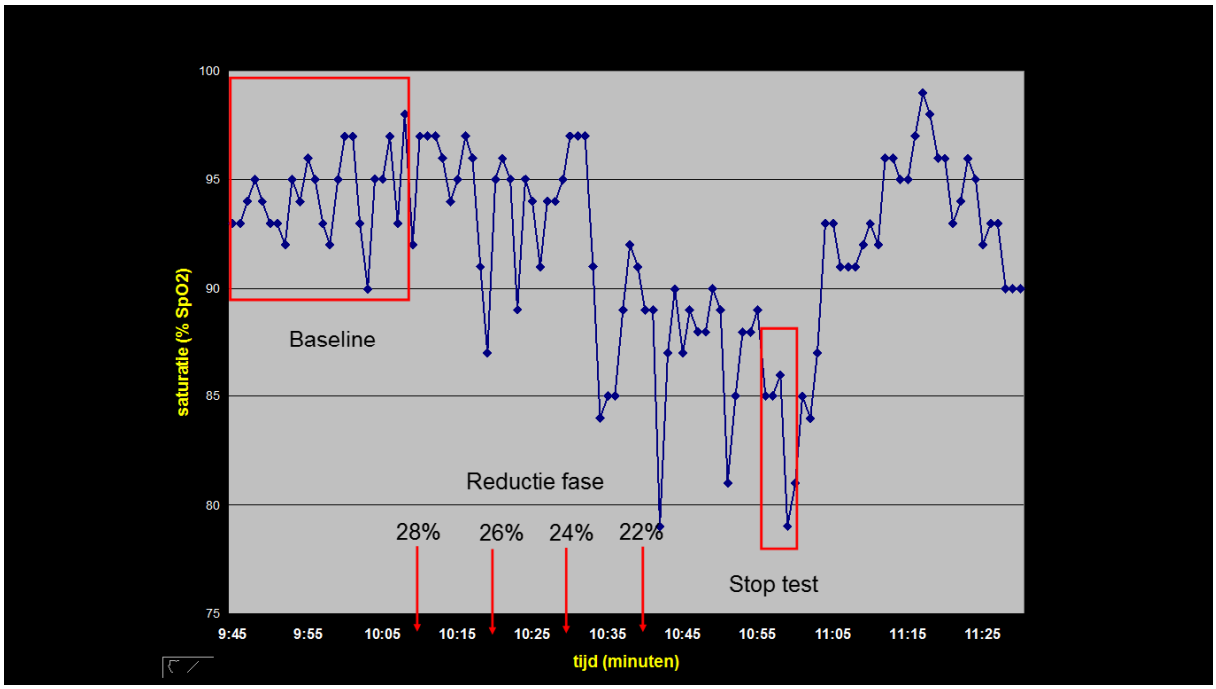
Phase 1: Baseline evaluation



Phase 2: Oxygen reduction



Phase 3: Observation period



Desaturation below 80% for > 1 minute: this patient is classified as moderate BPD.

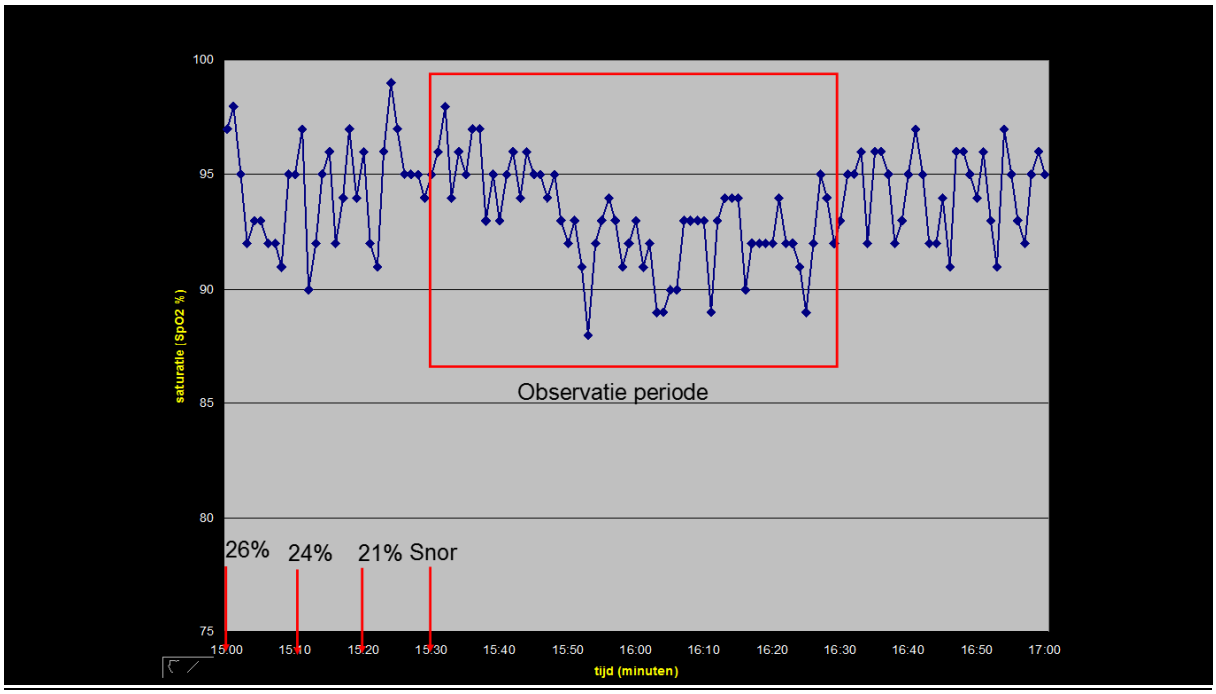
Phase 4: Back to situation before the test

Patient 2: CGA 36 weeks with nasal cannulae 30% supplemental oxygen

Phase 1: Baseline evaluation: not shown.

Phase 2: Oxygen reduction: first steps not shown, but reduction to 21% and nasal cannulae removed.

Phase 3: Observation period



During observation period (1 hour) did not have a desaturation below 80% for a consecutive period of > 1 minute or saturation between 80-87% for a consecutive period of > 5 minutes. This patient passed the oxygen reduction test and is classified as mild BPD.

Phase 4: Back to situation before the test