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Pulmonary Function Tests

Forced Deflation Technique[16]

A specially constructed forced deflation device was inserted between the endotracheal tube and anesthesia breathing circuit via a three-way slide valve. The lungs were inflated to the total lung capacity (TLC), defined as a static airway pressure of 40 cm H_2O, three times to eliminate any preexisting atelectasis and establish a consistent volume history. At the fourth inflation to the TLC, the three-way valve was slid rapidly to the position that occluded gas inflow and simultaneously opened the endotracheal tube to a negative-pressure reservoir (−40 cm H_2O), resulting in rapid deflation (within a few seconds) of the lungs via a pneumotachograph to the residual volume as the airway pressure decreased suddenly from +40 to −40 cm H_2O. Flow signals and the resulting volumes (obtained by instantaneous integration of the flow signals) were displayed immediately in the form of an x-y graph[16]. The resultant maximum expiratory flow-volume (MEFV) curves were used to calculate the FVC as well as the maximum expiratory flow rate at volumes that exceeded the residual volume by 25% and 10% of the FVC (MEF_{25} and MEF_{10}). After each forced deflation maneuver, the lungs were reinflated to the TLC to eliminate any secondary airway closure and atelectasis.

Passive Deflation Technique[16]

The lungs were inflated to an end-inspiratory pressure of 10 cm H_2O and passively deflated to the end-expiratory volume (functional residual capacity [FRC]) via a pneumotachograph. The absolute Crs value (the change in volume divided by the change in pressure) was obtained by dividing the exhaled tidal volume by the distending pressure (10 cm H_2O). The absolute Crs value was then divided by body weight, resulting in a normalized value expressed in mL/cm H_2O/kg, to allow comparisons of patients with different body sizes[16].

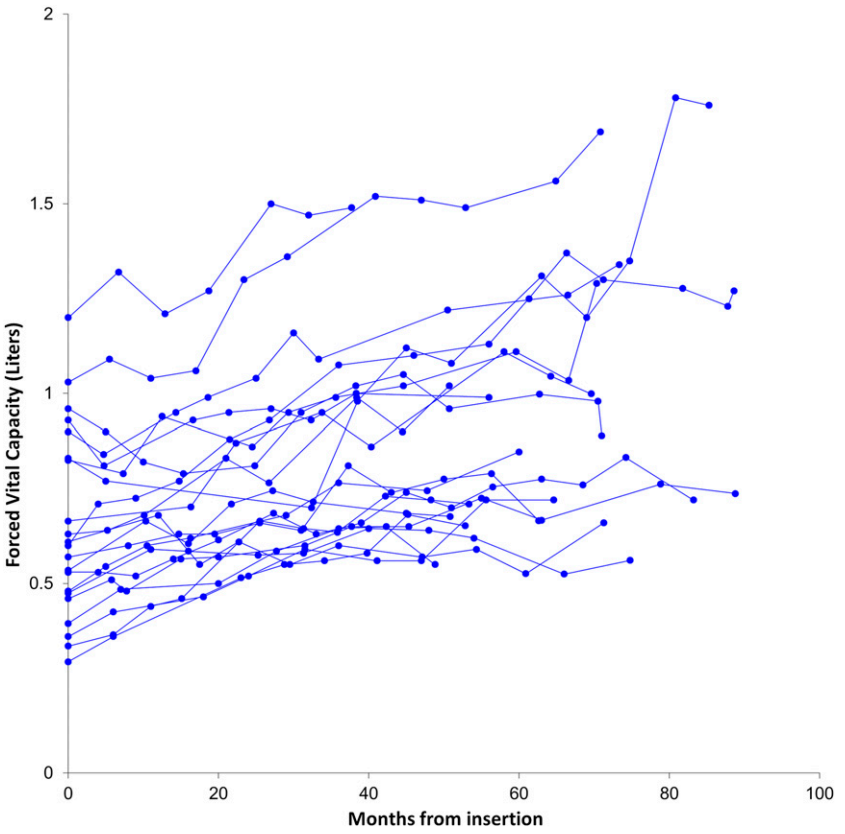

Fig. E-1

Changes in actual FVC over time for the twenty-one patients. Each point represents the pulmonary function test at the time of implantation or a lengthening surgery.

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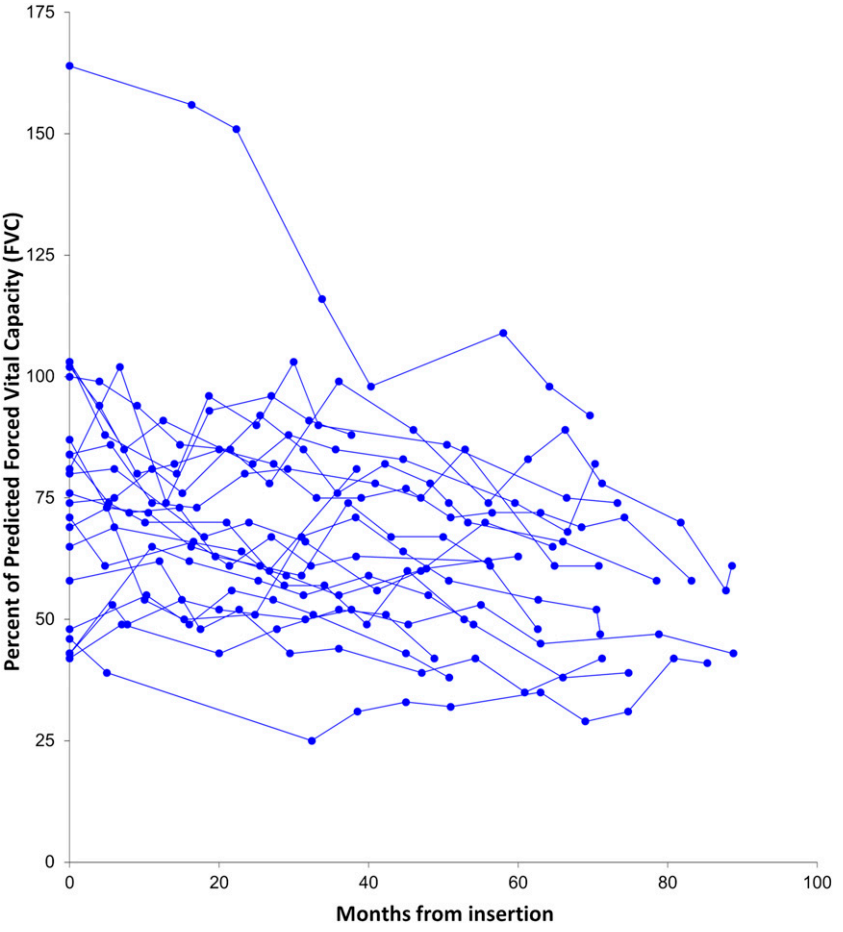

Fig. E-2

Changes in FVC over time for the twenty-one patients, expressed as the percentage of the predicted value on the basis of arm span. Each point represents the pulmonary function test at the time of implantation or a lengthening surgery.

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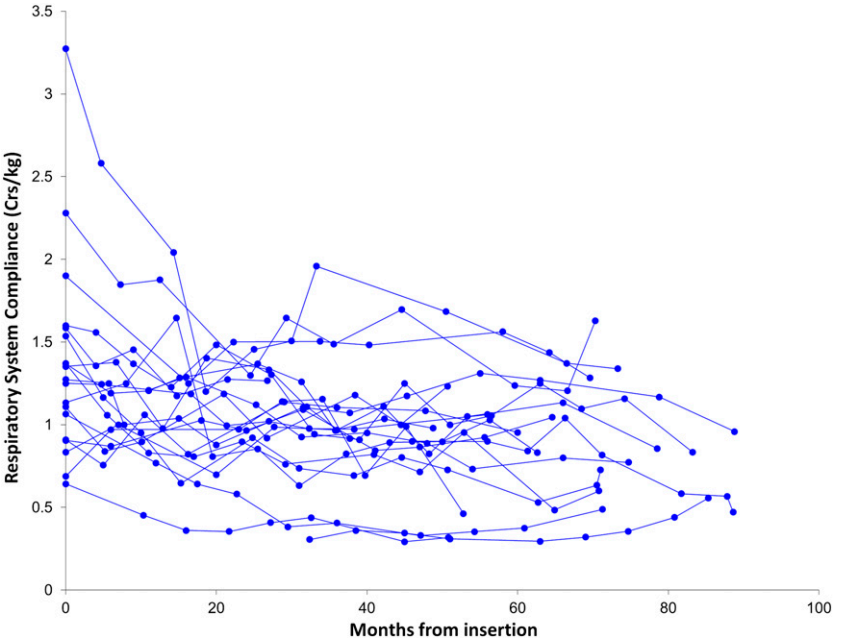

Fig. E-3

Changes in normalized Crs (in mL/cm H_2O/kg) over time for the twenty-one patients. Each point represents the pulmonary function test at the time of implantation or a lengthening surgery.

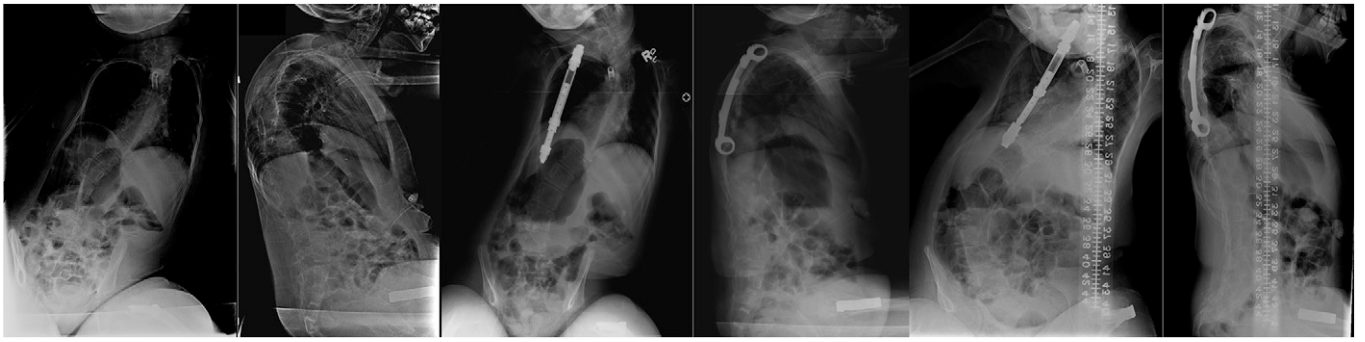

Fig. E-4

Posteroanterior and lateral spine radiographs made before implantation (first two panels), before the first expansion (middle panels), and at the time of the last follow-up (last two panels) in a patient who had increasing proximal thoracic kyphosis over time and the persistence of spinal imbalance. Note that the proximal cradle of the VEPTR remained in place but the proximal aspect of the thoracic spine appears to have migrated anteriorly and become more kyphotic.