Intraoperative Neurophysiologic Monitoring (IONM) during High Risk Spinal Surgery

Helen Wai-Man Lee(1), Sam Yat-Chau Law(1), Stanley Chun-Pong Lau (1),Christy Wing-Ting Law(1), Bill Fai-Chun Cheng(1), Ka-Kin Li(2), Chin-Hung Ho(2), Kin-Hung Cheng(2), Chun-Kong Wong(2), Raymond Ping-Hong Chin(2)
(1)Department of Prosthetic and Orthotic, Queen Elizabeth Hospital, Hong Kong
(2)Spine and rehabilitation service, department of Orthopaedics and Traumatology, Queen Elizabeth Hospital, Hong Kong

Keywords:
Spine surgery
Intraoperative Neurophysiologic Monitoring
Sensitivity
Specificity

Introduction
Postoperative neurological deficit is one of the major risks in spinal surgery. In 1970s, Stagnara wake up test is the only available method for observing spinal cord integrity after major procedures of spinal surgery. However, reliability affected by, namely patient's cooperation and waking up time. The advent of intraoperative neurophysiologic monitoring (IONM) provides a comprehensive way to monitor the functional status of somatosensory and motor pathway of patient throughout the procedure. With collaboration between spine surgeon, anesthetist, IONM technologist and nurses, surgical complications could be reduced and patient safety can be enhanced. It is commonly implemented in various hospitals internationally.

Objectives
In this review, we would like to evaluate the sensitivity and specificity of IONM for detection of intraoperative neurological injury in spinal surgeries in Queen Elizabeth Hospital (QEH).

Methodology
All patients (N=13) underwent spinal surgeries between September 2013 and February 2014 were included. Pre-operative clinical examination, including neurological and radiological examinations, has been performed by spine surgeons. In addition, technologist trained in IONM, is responsible for pre-operative somatosensory evoke potential (SSEP) and intraoperative various monitoring modalities. Surgeons were informed immediately on the changes of evoke potential (EP) when reaching alarming level. Post-operatively, surgeons assessed patient again to document any possible new neurological deficits clinically for comparison of results.

Result

Thirteen patients, 6 females and 7 males, with mean age of 62.3 years, underwent spinal surgeries involving 5 cervical, 3 thoracic and 5 lumbar segments and received 28 times of monitoring modalities, including SSEP, motor EP and simultaneous electromyogram. Major operation procedures consisted of 6 laminectomy, 10 instrumentation, 10 spinal fusion and 3 tumor excision. Average operation hour was 5 hours. One hundred and thirty alarms were given to surgeons for attention or adaptation of procedure. Eight patients presented with true-positive findings, among them, clinical symptoms of seven patients were resolved within two weeks post-operatively but one patient, who had a record of non-operative injury at Day 1, with persistent clinical symptoms. One patient presented false-negative finding in cervical laminectomy surgery. Clinical symptoms improve after physiotherapy. One patient presented false-positive finding, no clinical symptom was observed post-operatively. Two patients presented true-negative findings. One patient was excluded due to complication at Day 2. As a result, sensitivity and specificity of IONM for neurological injury detection were calculated as 87.5% and 66.7%, respectively. IONM is an effective way of monitoring the functional status of spine involving high risk surgical procedure.