Short report

A note on the deep abdominal reflex

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SUMMARY Deep abdominal reflexes were recorded electromyographically in six patients with lesions of the upper motor neuron. The responses were bilateral, usually with identical latencies which ranged from 16.5 to 25 ms. Individual variation was never greater than 3 ms. It is postulated that these bilateral responses of abdominal muscles were independent stretch reflexes and were not mediated across the midline through an intraspinal pathway.

In patients with lesions of the upper motor neuron, deep abdominal reflexes are usually enhanced while superficial abdominal reflexes are depressed or abolished.¹ Bilateral contractions of abdominal muscles may be encountered in both reflexes. Like other cutaneous reflexes, the superficial abdominal reflex is probably mediated across the midline through an intraspinal pathway.^{2,3} This study was undertaken to determine the mechanism responsible for the bilateral contractions accompanying the deep abdominal reflex.

Methods

Six patients with lesions of the upper motor neuron and brisk deep abdominal reflexes were selected for study. All demonstrated bilateral contractions of abdominal muscles when these reflexes were elicited. The blows were applied by reflex hammer to the examiner's fingers which were placed over the insertions of either a rectus abdominis or external oblique muscle at the inferior margin of the rib cage. In this manner, stretch of abdominal muscles was produced. An accelerometer mounted at the base of the reflex hammer triggered the sweeps of the oscilloscope when contact with the fingers was made. The interval between contact and onset of the sweep was less than 0.4 ms.

Action potentials were recorded from abdominal muscles by paired electrodes which were fixed on each side of abdomen from 5.0 to 12.0 cm lateral to the umbilicus. After amplification, representative tracings were

photographed on the two-beam oscilloscope of a TE-4 EMG machine.

Results

With weak blows the responses were usually confined to the ipsilateral side while stronger blows were accompanied by bilateral responses. In general, the stronger blows were associated with the shorter latencies. This latency variation, however, was never more than 3 ms in any one subject. The latencies of the responses ranged from 16.5 to 25 ms in all subjects. The amplitude of the ipsilateral response was usually greater than the contralateral.

Identical latencies were usually obtained for ipsilateral and contralateral responses following blows to either side of the abdomen. On occasion, these latencies were different; the ipsilateral response was either shorter or longer than the contralateral. Never was this range more than 3 ms. In three of these patients all three types of results were encountered. These variations seemed to be dependent on the site of the blow. For instance, blows to the external oblique muscle were more often associated with an ipsilateral latency shorter than the contralateral, while blows to rectus abdominis were accompanied by equal or even shorter latencies on the contralateral side.

Blows to midline at the xiphoid were performed in a few patients. These responses were usually bilateral, of equal latency and similar amplitude.

In fig 1 the action potentials were recorded from right and left abdominal muscles following a blow to the insertion of the right rectus abdominis muscle. The latencies of the muscle action potentials

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Fig 1 Action potentials recorded from right and left abdominal muscles following a blow to the right rectus abdominis.

were 19 ms. The amplitude was greater on the ipsilateral side.

Discussion

In the recordings from our patients, additional features indicated that these deep abdominal reflexes were stretch responses. These included the relatively short and constant latency as well as the configuration of the action potential. The latter suggested a synchronous discharge of anterior cells which is usually associated with a stretch reflex.

The mechanism which was postulated for the bilateral responses which were recorded from abdominal muscles in these patients is shown schematically in fig 2. Following the blow to the abdominal muscles, a wave of motion travelled over the entire surface of the abdomen. The accompanying displacement of the recording leads produced a small artifact. On the tracings, this commenced from 2 to 3 ms after the blow; the contralateral artifact being 0.5 to 1 ms later than the ipsilateral. This wave stimulated muscle spindles in both sides of the abdomen almost simultaneously. A separate stretch reflex on each side was produced which accounted for the bilateral responses.

A mechanical transmission has also been postulated for the crossed adductor reflex in humans.⁴ In this reflex, however, the contralateral adductor muscle was stretched by the displacement of the pelvis. This irradiation of reflex activity has also been described by Lance and deGail⁵ in patients with brisk deep tendon reflexes.

In some patients, variations in the latencies of the responses from abdominal muscles were encountered which could not be explained entirely on the basis of the basis of the clinical findings or the intensity of

Fig 2 Diagrammatic representation of the deep abdominal reflexes. The unilateral blow to abdominal surface, indicated by the arrow, stretches abdominal muscles on both sides. Muscle spindles are stimulated and reflex contractions of abdominal muscles occur bilaterally.

the blows. The location of the blow did seem to have some influence on the latencies in that identical latencies were more likely to be recorded when the blows were directed to the rectus abdominis muscle as compared to the external oblique. A plausible explanation was not forthcoming, however, for the patients in whom the ipsilateral latencies were longer than the contralateral.

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