

Motor Point Delineation of the Hip Joint Muscles for Functional Electrical Stimulation Using Perctaneous Intramuscular Electrodes: An Anatomic Study

Abstract— The anatomical study was performed to delineate the motor point of the hip muscles for the exact implantation of percutaneous intramuscular electrodes. Six extremities of three cadavers were dissected. The subjects consisted of one male and two females. The following muscles were dissected; gluteus maximus (GM), gluteus medius (Gm) and adductor magnus (ADD). Nerves and motor points were delineated. Motor point was represented as the %distance from the line between following landmarks; spina iliaca posterior superior (SIPS), greater trochanter (GT), tuber ischiadicum (TI) and lateral epicondyle (LE). Lateral (lat.) or medial (med.) deviation from the line were also represented as the %deviation length. The %distances and %deviation lengths of three motor points of GM were 46(lat.29), 63(lat.7) and 86(lat.18)% of the line SIPS-TI, respectively. The %distances and %deviation lengths of three motor points of Gm were 35(lat.1), 49(lat.9) and 61(lat.7) % of the line SIPS-GT, respectively. The %distance and %deviation length of one motor point of ADD was 58(med.8)% of the line SIPS-LE. The motor points shown in this study is useful to shorten operation time by exact insertion of percutaneous intramuscular electrodes.

Index Terms— functional electrical stimulation, motor point, intramuscular electrode

I. INTRODUCTION

We have adopted percutaneous intramuscular electrodes for functional electrical stimulation[4], [5]. Anatomy atlas and textbooks were referred to at the time of percutaneous intramuscular electrodes insertion, however the motor point shown in these books are not detailed[3], [6], [7]. The motor point of the gluteus medius for implantation of epimysial electrodes was reported by Botte, et al.[1], however, motor points of other hip muscles have not been reported. A more precise motor point map is necessary for percutaneous intramuscular electrodes insertion.

II. PURPOSE

The purpose of this study was to delineate the motor point of the hip muscles for the exact implantation of percutaneous intramuscular electrodes.

III. MATERIALS AND METHODS

Six extremities of three cadavers were dissected. The subjects consisted of one male and two females. The height was 152.6 cm. The following muscles were dissected; gluteus maximus (GM), gluteus medius (Gm) and adductor magnus (ADD). Nerves and motor points were delineated. Motor point was regarded as the place where the ramus muscularis penetrates the fascia (Fig. 1). Motor point was represented as the %distance from the line between following landmarks; spina iliaca posterior superior (SIPS), greater trochanter (GT), tuber ischiadicum (TI) and lateral epicondyle (LE). Lateral (lat.) or medial (med.) deviation from the line were also represented as the %deviation length (Fig. 2).



Fig. 1 Ramus muscularis penetrates the fascia

IV. RESULTS

The %distances and %deviation lengths of three motor points of GM were 46(lat.29), 63(lat.7) and 86(lat.18)% of the line SIPS-TI, respectively (Fig. 3). The %distances and %deviation lengths of three motor points of Gm were 35(lat.1), 49(lat.9) and 61(lat.7) % of the line SIPS-GT, respectively (Fig. 4). The %distance and %deviation length of one motor point of ADD was 58(med.8)% of the line SIPS-LE(Fig. 5).

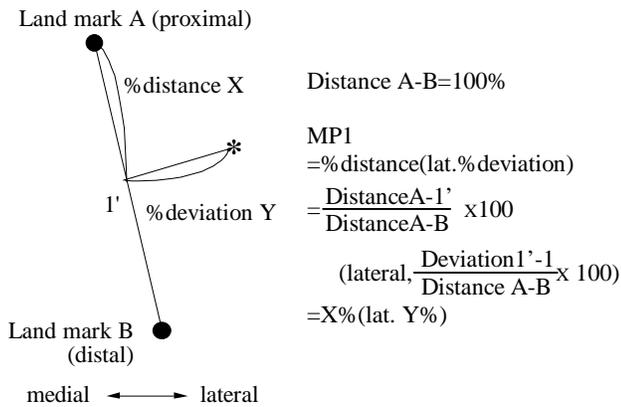


Fig. 2 Legend

V. DISCUSSION

Marsolais et al. stimulate the muscles for hip extension; adductor magnus, gluteus maximus, semimembranosus and biceps femoris[2]. Our stimulated muscles for hip extension and abduction are gluteus maximus, adductor magnus and gluteus medius. Marsolais et al. reported the implantation technique of percutaneous intramuscular electrodes[2]. We implanted the electrodes according to their technique. Motor points shown in their report, anatomy atlas and textbook are not precise. Only Botte, et al.[1] have reported the motor point of Gm. They reported that the motor point of Gm was one third of the line SIPS-GT. In our study, the Gm motor points were approximately from one third to two third of the line SIPS-GT. The two studies are almost accordant. Other motor points shown in this study lead to shorter operation time as a result of exact insertion of percutaneous intramuscular electrodes.

References

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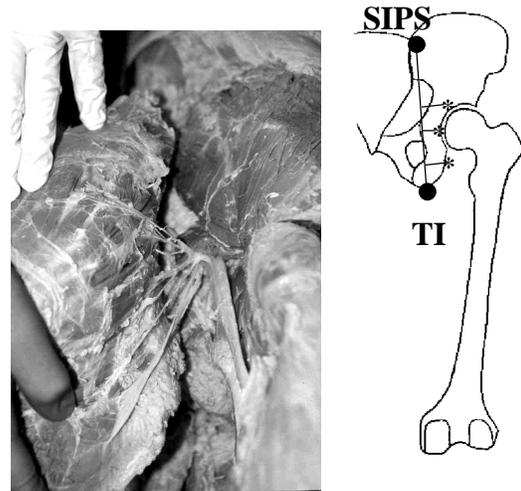


Fig. 3 Motor point of the gluteus maximus

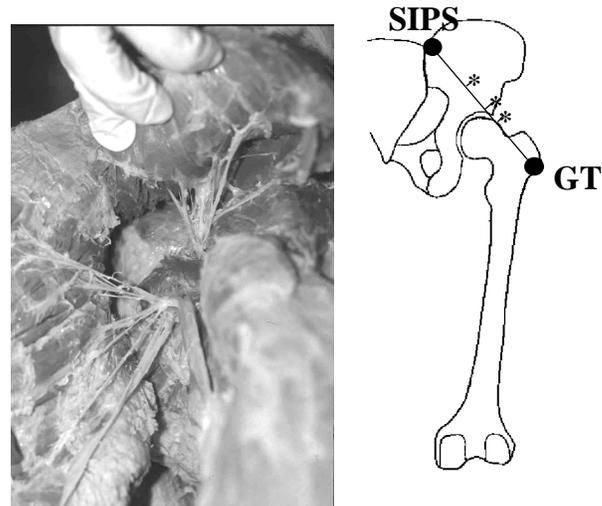


Fig. 4 Motor point of the gluteus medius

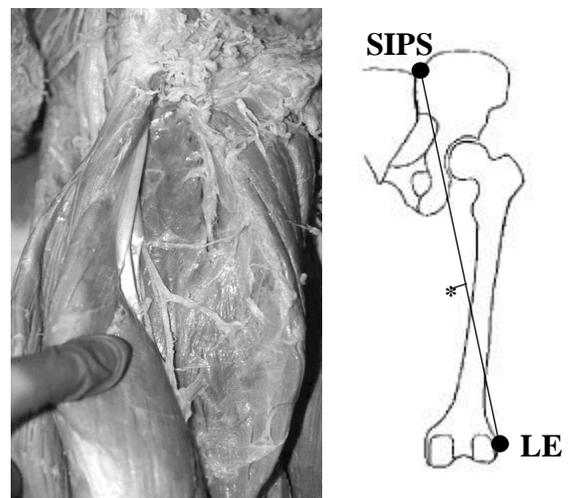


Fig. 5 Motor point of the adductor magnus