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Anatomical Locations in the Trunk Correlated with Basic Massage Lines and Signaling Points of *Nuad Thai*

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Abstract

Court-Type Thai Traditional Massage (CTTM) or *Nuad Thai* (Thai massage) *Raja Sum Nak* is an effective treatment for musculoskeletal disorders that are commonplace in Thai infirmaries and has specific major lines or points for massage with deep compression and rhythmic gentle pressing. The aims of this study were to compare surface landmarks and anatomical structures of the trunk in major basic massage lines (BLs), massage points (MPs) and signaling point (SPs) between healthy volunteers and cadavers by percussion, auscultation, bimanual palpation and dissection including measuring the applied pressure force by acupressure test in healthy volunteers. In healthy volunteers, percussion or auscultation in lines and points of abdominal region demonstrated a bowel sound, whereas for the back region a dull sound was demonstrated. Palpation indicated there were muscles in both abdominal and back regions in all lines and points of CTTM. Dissection of cadavers revealed the anatomical structures in the abdomen beneath major locations were mainly organs of the gastrointestinal (GI) system with their associated small vessels and the large vessels. For the back area, BLs and SPs are verified to be mostly muscular structures with their associated vessels and nerve branches. The BLs of the shoulder correspond to the fleshy part of the upper trapezius muscle with related underlying vessels and nerves. The averages of the commonly applied finger's pressure massage on abdominal, back and shoulder areas were 5.32 $\pm$ 1.28 kg, 11.6 $\pm$ 1.45 kg and 8.5 $\pm$ 0.36 kg, respectively. The trunk MPs, BLs and SPs used in CTTM are associated with or closely correlated to important anatomical structures, especially GI tract organs, blood vessels, nerves and paravertebral muscles. The results of this study are important for clinical practice and could lead to effective treatment with patient safety.

Key words: *Nuad Thai* (Thai massage), basic massage lines, signaling points, pressure value

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ตำแหน่งทางกายวิภาคของลำตัวที่ตรงกับแนวเส้นพื้นฐานและจุดสัญญาณของการนวดไทย

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บทคัดย่อ

การนวดไทยแบบราชสำนักเป็นการรักษาที่เน้นประสิทธิผลต่อการบำบัดโรคทางระบบกล้ามเนื้อและโครงสร้าง (musculoskeletal system) ซึ่งมีเส้นและจุดที่จำเพาะต่อการนวดด้วยแรงกดลึก โดยใช้จังหวะการแต่งรสมือขณะนวด การศึกษานี้จึงมีวัตถุประสงค์เพื่อเปรียบเทียบตำแหน่งและโครงสร้างทางกายวิภาคบริเวณลำตัวตามแนวเส้นพื้นฐานและจุดสัญญาณ ด้วยการฟัง การเคาะ การคลำ การกด การนวด รวมถึงการใช้ชุดทดสอบการกดจุดสำหรับการนวดไทยแบบราชสำนักเพื่อวัดขนาดของแรงขณะนวดตามแนวเส้นพื้นฐานและจุดสัญญาณบริเวณลำตัวในผู้เข้าร่วมวิจัยปกติพร้อมบันทึกผล และการชำแหละในศพดอง ผลการศึกษาพบว่า เมื่อฟังหรือเคาะบริเวณท้องในผู้เข้าร่วมวิจัยมีเสียงโปร่ง ขณะที่เคาะบริเวณหลังมีเสียงทึบ จากการคลำพบแนวกล้ามเนื้อในบริเวณทั้งสอง ในขณะที่ผลการใช้ชุดทดสอบการกดจุดขณะนวดด้วยนิ้วมือบริเวณท้อง, หลัง และบ่าในผู้เข้าร่วมวิจัยมีค่าเฉลี่ยเท่ากับ 5.32 ± 1.28 กิโลกรัม, 11.6 ± 1.45 กิโลกรัม และ 8.5 ± 0.36 กิโลกรัม ตามลำดับ ผลการชำแหละศพดองพบว่าแนวเส้นพื้นฐานและจุดสัญญาณท้องตรงกับอวัยวะต่าง ๆ ภายในช่องท้อง หลอดเลือดที่เลี้ยงอวัยวะของระบบทางเดินอาหารรวมถึงหลอดเลือดแดง abdominal aorta และหลอดเลือดดำ inferior vena cava ด้วย ในขณะที่แนวเส้นพื้นฐานและจุดสัญญาณบริเวณหลังตรงกับตำแหน่งจุดเกาะต้นของกล้ามเนื้อข้างกระดูกสันหลัง (paravertebral muscles) และพบว่าเป็นบริเวณที่แขนงประสาท (posterior rami) ของเส้นประสาทไขสันหลัง (spinal nerves) แทงเข้ากล้ามเนื้อ (motor points) หรือทะลุกล้ามเนื้อขึ้นไปยังผิวหนัง ส่วนแนวเส้นพื้นฐานบ่าอยู่ตรงกับตำแหน่งของมัดกล้ามเนื้อทราปีเซียส (Trapezius) พบหลอดเลือดและเส้นประสาทวางตัวอยู่ใต้ต่อมัดกล้ามเนื้อนี้ จะเห็นได้ว่าแนวเส้นพื้นฐาน และจุดสัญญาณของการนวดไทยแบบราชสำนักบริเวณลำตัวสอดคล้องกับโครงสร้างทางกายวิภาคของกล้ามเนื้อ หลอดเลือด เส้นประสาท และอวัยวะของระบบทางเดินอาหาร ซึ่งผลการศึกษาดังกล่าวสำคัญต่อประสิทธิผลและความปลอดภัยในการรักษาผู้ป่วยด้วยการนวดไทยแบบราชสำนัก

คำสำคัญ: การนวดไทย, แนวเส้นพื้นฐาน, จุดสัญญาณ, ค่าของแรงกด

Introduction

Court-type Thai traditional massage (CTTM) or *Nuad Thai Raja Sum Nak* is a procedure practiced for musculoskeletal diseases in Thailand with a gentle and deep pressure massage in a momentary sustained compression on the points and lines into the therapeutic target area and according to the imaginary lines or *"Sen Prathan sib"*.[1-5] The imaginary lines have been described as hypoth-

esized energy lines running through the body and help to increase awareness; vitality, including energy can flow to the body in a balanced manner if these lines are unblocked[5, 6]. CTTM involves the use of hands and fingers to apply pressure force at specific points on the imaginary lines, for example basic massage lines (BLs), massage points (MPs), and signaling points (SPs)[7-12] for practical examination, diagnostic assessment and treatment[1-2, 11-12]. The reported effectiveness of CTTM includes reduced pain intensity in patients with chronic tension-type headaches[13], improved physical fitness in patients suffering from paralysis, decreased spasticity, increased functional ability and quality of life including decreased anxiety and depression scores in elderly stroke patients[14]. Previous study found that most of the trigger points of myofascial pain syndrome (MPS], a common musculoskeletal condition throughout the body, fall along the imaginary lines[15]. Moreover, there were several CTTM diseases of the trunk including both of abdominal and back regions such as: *Dan Leuat* (ดานเลือด), *Dan Lom* (ดานลม), *Yook* (ยอก)[1, 3, 11-12] *Lom Lam Bong* (ลมลำบอง), *Lom Prap* (ลมปราบ), *Lom Plai Pattakhat* (ลมปลายปัตคาต)[9, 11-12], erectile dysfunction, paralysis and pelvic relaxation[1, 3, 11-12] which needed CTTM treatment. Thus, it is beneficial for massage therapy if we know the anatomical structures associated with the imaginary lines and apply pressure from the therapist on those lines. However, few studies have investigated the correlation between CTTM and anatomical structures. Only the relationships of upper and lower limb anatomical structures with BLs, MPs, and SPs have been reported[9-10] but the trunk has not yet been investigated. The goals of this study are important as they promote a clear understanding of CTTM in relation to the structures of the trunk including the abdominal and back regions of the human body and measure a force pressure value of digits or hands of the therapist during massage by the Acupressure Testing Set for Thai Therapeutic Massage (TTM)[16]. It can be useful for CTTM practical examination, clinical evaluation and treatment for CTTM practitioners. The findings of this study will also help CTTM practitioners integrate and correlate this basic knowledge into clinical practice, leading to effective treatment and patient safety.

Methodology

Experimental design

This study was divided into 2 parts namely, 1) human study and 2) anatomical study. The protocol was approved by the Ethics Committee of Mahasarakham University (ref. no 024/2016), Maha Sarakham, Thailand.

Human study

Participants

Six healthy volunteers (3 males, 3 females) students of Applied Thai Traditional Medicine with the following inclusion criteria; anatomically unremarkable, male height 165-175 cm female height 155-165 cm, Body Mass Index (BMI) 18-22.5 kg/m^2. Participants with fractures, vertebral abnormality, trauma, and tumor were excluded.

Location

The BLs, MPs and SPs were located by an Applied Thai Traditional Medicine practitioner and marked on the trunks of six healthy volunteers. All of the lines and points were percussion, auscultation, and manual palpation. Important locations were classified as described in table 1.

The average finger (digit) and palm (heel of hand) dimensions determined previously[9] were used to located BLs, MPs and SPs in this study.

Finger Pressure Massage Measurement

The finger's pressure massage at the trunk was measured by one researcher during massage in the healthy volunteers (n = 6) using the Acupressure Testing Set for TTM. Acupressure Testing Set for TTM was adopted for the force measuring device of finger pressure at each line and point (three time per one volunteer) and mean value were calculated. This tool was designed by the Department of Mechatronics Engineering, Mahasarakham University Faculty of Engineering[16] (Figure 1).

Anatomical study

Cadaver

Five cadavers were used: 3 males and 2 females, aged between 60 and 80 years with mean age 70.8 ± 7.6 years (mean ± SD). All cadavers had signed body donation consent prior to their deaths to Department of Anatomy, Faculty of Medicine, Khon Kean University, Thailand. They were kept in supine position covered with a plastic bag in the anatomical laboratory, Mahasarakham University, Maha Sarakham, Thailand during 2016. Cadavers with a history of abnormalities, skin lesions, surgical lesions, bone fractures, trauma, and tumor involving the abdomen, and back were excluded from this study.

Dissection

The 6BLs, 5MPs and 10 SPs were located and marked as shown in table 1 and dissected according to laboratory guidelines based on Cunningham's Manual of Practical Anatomy by a specialist in Applied Thai Traditional Medicine and anatomist to determine

Table 1 The 6 BLs, 5MPs and 10 SPs are located in this study

Lines/points	Area	Definition	Massage–digit/palm	Figure
Lines				
Rt. *waek* line (RWL)	Abdomen	located at the upper border of the umbilicus	2^{nd}, 3^{rd},	2
Lt. *waek* line (LWL)	Abdomen	1 fingerbreadth and this line is adjacent to the midline of the body to 2 fingerbreadths below the xiphoid process.	4^{th} digit	
Rt. *nap* line (RNL)	Abdomen	located at the lower border of the xiphoid process		3
Lt. *nap* line (LNL)	Abdomen	2 fingerbreadths and this line is adjacent to the midline of the body 1 fingerbreadth to 1 fingerbreadth above the umbilicus.		
Line of back in both side (LB)	Back	an imaginary line drawn from the iliac crest and this line is adjacent to the vertebral column to the 7^{th} cervical spinous process.	Tip of thumb	4
Line of shoulder in both side (LS)	Back	a line starting from adjacent to the acromioclavicular joint adjacent to the 7^{th} cervical spinous process.		5
MPs				
Rt. *waek* (RW)	Abdomen	located at the intersecting point between a vertical	2^{nd}, 3^{rd},	2
Lt. *waek* (LW)	Abdomen	line lateral to the midline of the body 1 fingerbreadth and a horizontal line below the umbilicus 1 fingerbreadth.	4^{th} digit	
Rt. *nap* (RN)	Abdomen	located at the same level points whereas the vertical		3
Lt. *nap* (LN)	Abdomen	line was laterally to *waek* MPs about 1 fingerbreadth		
Epigastric *nap* point (EP)	Abdomen	located at the intersecting point between a midline of the body and a horizontal line below the xiphoid process 2 fingerbreadths.		3
SPs				
Abdominal SP1 (ASP1)*	Abdomen	area medial to *Hua Ta Kak* point (anterior superior iliac	2^{nd}, 3^{rd},	6
Abdominal SP2 (ASP2)*	Abdomen	spine: ASIS) which are located both sides of the body.	4^{th} digit	
Abdominal SP3 (ASP3)	Abdomen	located at the Lt. and Rt. intersecting point between		
Abdominal SP4 (ASP4)	Abdomen	a lateral area close to a midline of the body and a horizontal line 1 fingerbreadth above the umbilicus		
Abdominal SP5 (ASP5 or *Peod Pratu Lom*)*	Abdomen	the intersecting point between a midline of the body and a horizontal line above the umbilicus. 2 fingerbreadth.	Heel of hand	6
Back SP1 (BSP1)	Back	located at the intersecting point between a vertical line adjacent to the vertebral column and a horizontal line passing through the highest point of the iliac crest.	Tip of thumb	7
Back SP2 (BSP2)	Back	located at the intersecting point between a vertical line lateral to the vertebral column 1 fingerbreadth and a horizontal line at the subcostal space.		
Back SP3 (BSP3)	Back	located at the intersecting point between a vertical line same as BSP1, while a horizontal line is on the 12^{th} ribs.		
Back SP4 (BSP4)	Back	the point located at adjacent to the 1^{st} thoracic spinous process.		
Back SP5 (BSP5)	Back	the point located approximately 1 fingerbreadth above BSP4 and adjacent to the 7^{th} cervical spinous process.		

*Points considered to be both MPs and SPs

the effects of applying pressure to the same lines and points of the abdominal and back regions. The presence of organs, muscles, arteries, nerves and bones were recorded photographically.

Results

The averages of the force pressure value (kg) of one researcher during massage along the points and lines in the volunteers are reported in Table 2 (Figure 1). The averages of a force pressure value were used to estimate the depth structures in relation to BLs, MPs and SPs in this study.

In the participants, tympanic percussion and auscultation at BLs, MPs, and SPs found a bowel sound in the abdominal region and a dull tone in the back region. The anatomical structures in the cadavers did not differ between male and female.

Table 2 Showing averages amount of pressure massage (kg) and S.D. in the volunteers (n = 6)

Points and lines	mean (kg)
1) WL and NL	4.8 ± 0.38
2) LB	10.6 ± 0.68
3) LS	8.5 ± 0.36
4) MPs	4.8 ± 0.38
5) ASP 1–4	6.5 ± 0.40
6) ASP5 (*Poed Pratu Lom* point)	4.6 ± 0.25
7) BSP 1–5	12.5 ± 0.37

The BLs

The first direction of CTTM was usually from caudal to rostral of the body. Except *nap* practice massage was from rostral to caudal.

After dissection, RWL and RNL were shown in three similar layers (superficial to deep structures). In the first layer, these lines ran along the ileum, transverse colon and the body part of stomach. In the second layer, the lines corresponded to the superior mesenteric vein (SMV) draining into the hepatic portal vein. In the third layer, both lines ran parallel to the inferior vena cava (IVC) and the anterior surface of vertebral bodies L3 to T10 level from caudal to rostral (Figure 8 and Table 3).

In cadavers, LWL and LNL were similar in the three layers (superficial to deep structures). In the first layer, these lines paralleled the jejunum, transverse colon and the body part of stomach. In the second layer, the lines corresponded and paralleled the superior mesenteric artery (SMA) that supplied blood into the small intestine. In the third layer, both lines paralleled the abdominal aorta (AbA) and the anterior surface of vertebral bodies L3 to T10 level from caudal to rostral (Figure 9 and Table 3). These were confirmed by pressing on these lines in volunteers, which caused decreased dorsalis pedis arterial pulse.

There were different structures between

lower and upper back. Therefore, we classified the LB into rostral line (T6-C7) and caudal line (L5-T7) vertebral spines. According to CTTM practice, the structures were described from caudal to rostral line.

LB was palpated in volunteers at the longitudinal line parallel to paravertebral muscle from L5-C7 vertebral spine level.

After removing the skin in the caudal line, LB corresponded to the thoracolumbar fascia. On deeper dissection, this line corresponded to a line between the origins and insertions of both multifidus lumborum and thoracis muscles (Figure 10).

In cadavers, the rostral line was shown in three similar layers of structures in the anatomical of the back. In the superficial layer, the line paralleled the medial area close to the origin of middle fiber of trapezius (Trap) muscle, where the cutaneous nerve emerged though this muscle, and where the superficial branch of transverse cervical artery (TCA) and spinal accessory nerve (CN XI) located underneath this muscle. Deeper than Trap, the line ran along the lateral area close to the origins of the rhomboid muscles 1 fingerbreadth, where the dorsal scapular nerve (DSN) and deep branch of transverse cervical artery (TCA) pass through underneath the rhomboid muscles. In the intermediate layer, the line ran parallel to the lateral area close to the aponeurotic origins of seratus posterior muscles. In the deep layer, the line ran parallel with the lateral area adjacent to the origin of splenius capitis (SpC) for 1 fingerbreadth. Deeper than the SpC, that line ran along the lateral area close to the insertion of spinalis thoracis (SpT) 1 fingerbreadth. Deeper than the SpT, the line paralleled the lateral area close to the belly part of semispinalis capitis and rotator muscles. In the deepest layer, the line corresponded to the point of posterior rami of spinal nerve that divided into two branches and the segmental arteries from the thoracic aorta emerged to intervertebral foramens (Table 3).

LS palpated at the shoulder in the volunteers that corresponded to the upper part of Trap from the acromion process to the spinous process of C7 level. Deeper dissection showed the LS line to the fleshy parts of supraspinatus (Sup) and levator scapulae (LeS) muscles. In the deepest part, the suprascapular nerve (SuN) and vessels pass through underneath the supraspinatus muscle (Table 3).

Massage points

RW and RN were situated on the ileum, where the ileocolic vessels distributed blood supply to this area. After dissecting deeper, the massage point was located at the right common iliac vessels and lay below the bifurcation of the abdominal aorta (Figure 11

Figure 1 Showing acupressure test of the one researcher while during massage along the points and lines by Acupressure Testing Set for TTM.

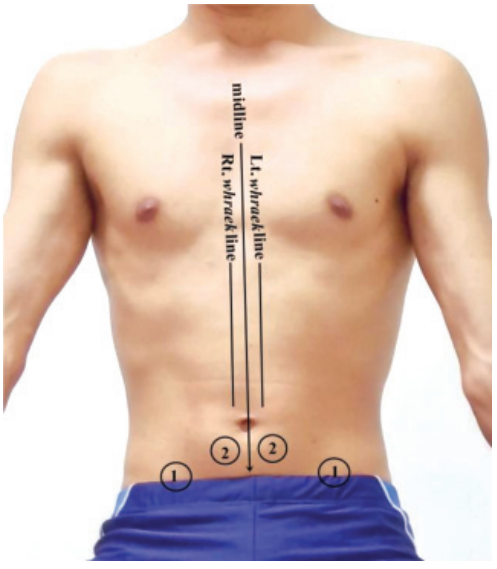

Figure 2 Anterior aspect of the trunk showing the locations of *waek* line, the medial area close to *Hua Ta Kak* (หัวตะคาก) point (Rt. and Lt.; 1) and the Rt. and Lt. below the umbilical point of *waek* (แหวก) practice (2).

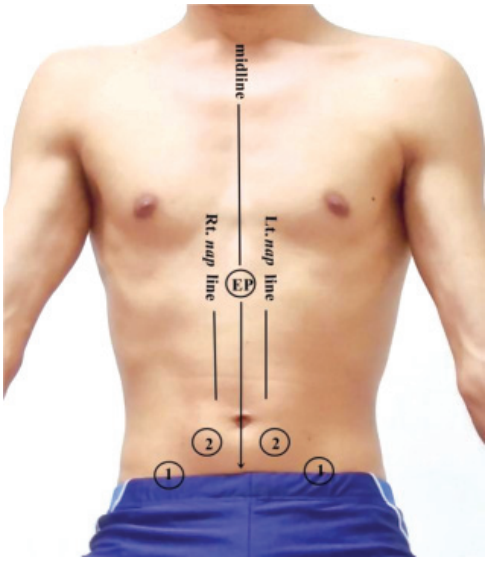

Figure 3 Anterior aspect of the trunk showing the locations of points and *nap* line, epigastric *nap* point (EP), Rt. and Lt. below the umbilical point (2) and Rt. and Lt. area close to the *Hua Ta Kak* points (1) of *nap* (นาบ) practice.

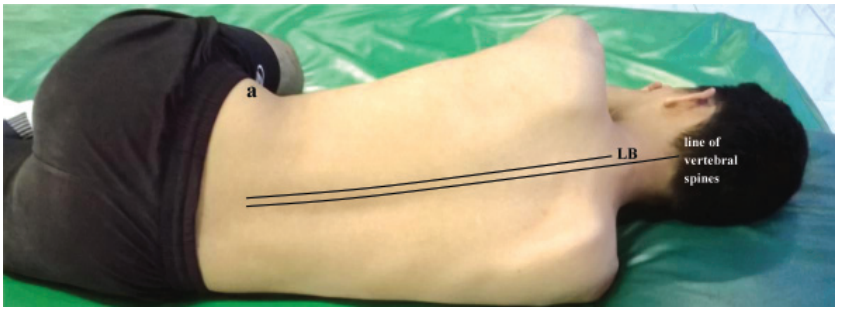

Figure 4 Posterior aspect of the trunk showing the location of LB, highest point of iliac crest (a).

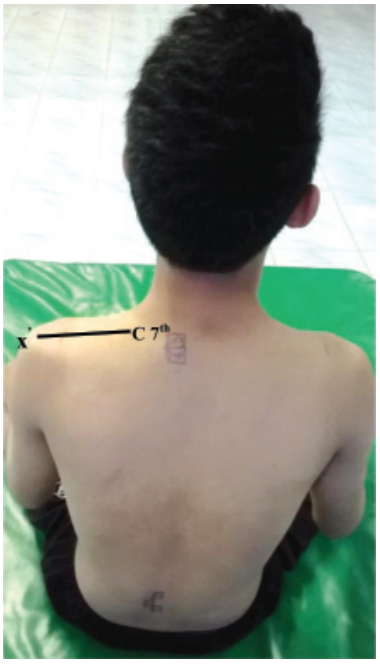

Figure 5 Posterior aspect of the trunk showing the location of LS. $C7^{th}$, cervical spinous process; x', acromioclavicular joint.

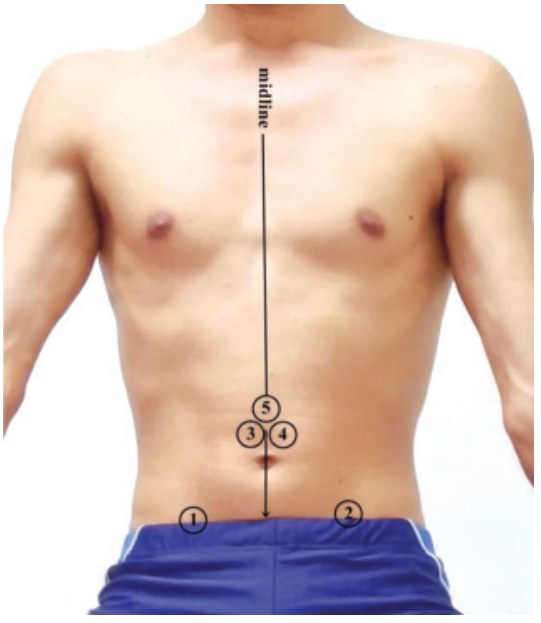

Figure 6 Anterior aspect of the trunk showing the location of ASP1 to ASP5.

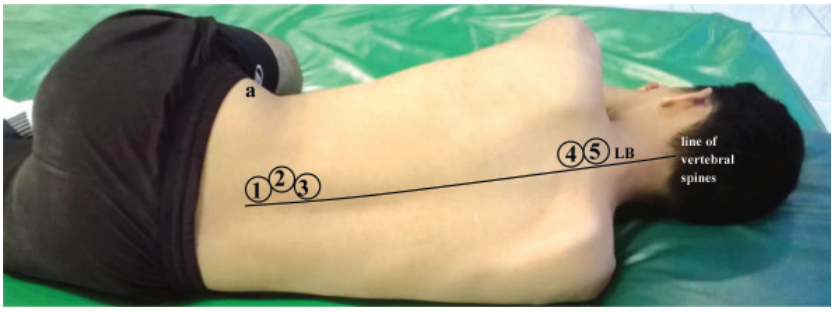

Figure 7 Posterior aspect of the trunk showing the location of BSP1 to BSP5.

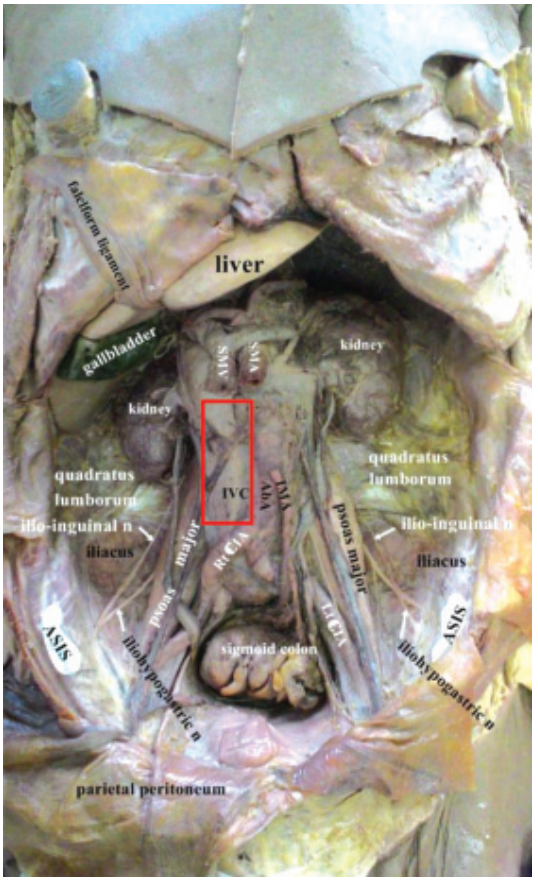

Figure 8 Deeper dissection of an abdomen showing the location of RWL and RNL corresponding to the IVC. ASIS, anterior superior iliac spine; IMA, inferior mesenteric artery; Lt. CIA, left comom iliac artery; Rt. CIA, right common iliac artery; SMA, superior mesenteric artery; SMV, superior mesenteric vein; X, xiphoid process.

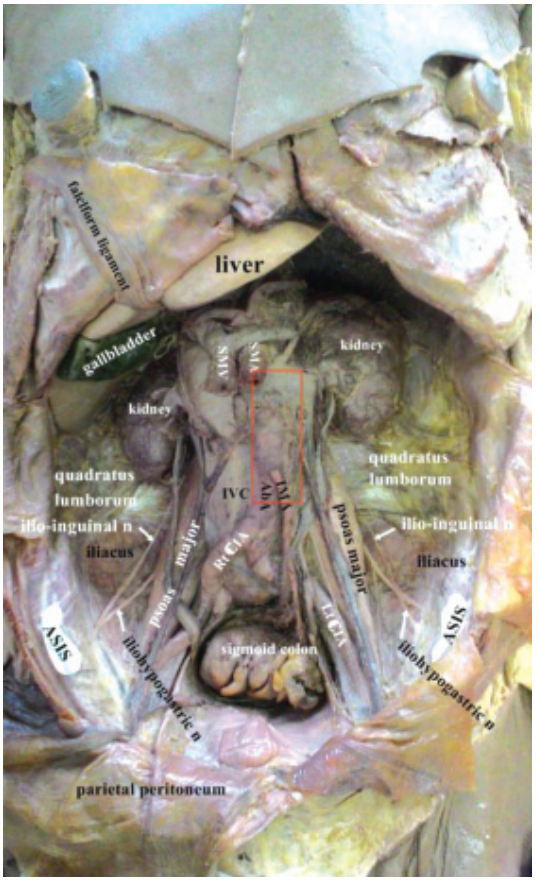

Figure 9 Deeper dissection of an abdomen showing the location of LWL and LNL corresponding to the AbA. AbA, abdominal aorta; IMA, inferior mesenteric artery; IVC, inferior vena cava; Lt. CIA, left common iliac artery; Rt. CIA, right common iliac artery; SMA, superior mesenteric artery; SMV, superior mesenteric vein; X, xiphoid process.

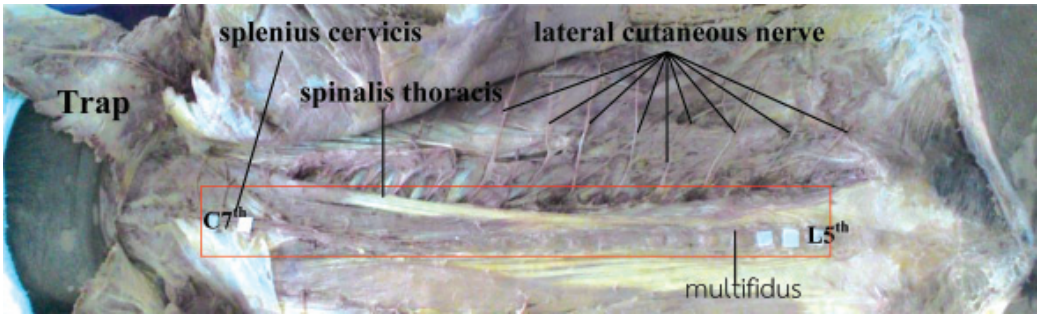

Figure 10 Deeper dissection of the back showing the location of LB corresponding to the posterior rami of spinal nerve emerged from the lateral border of multifidus muscle. C7th, 7th cervical spinous process; L5th, 5th lumbar spinous process.

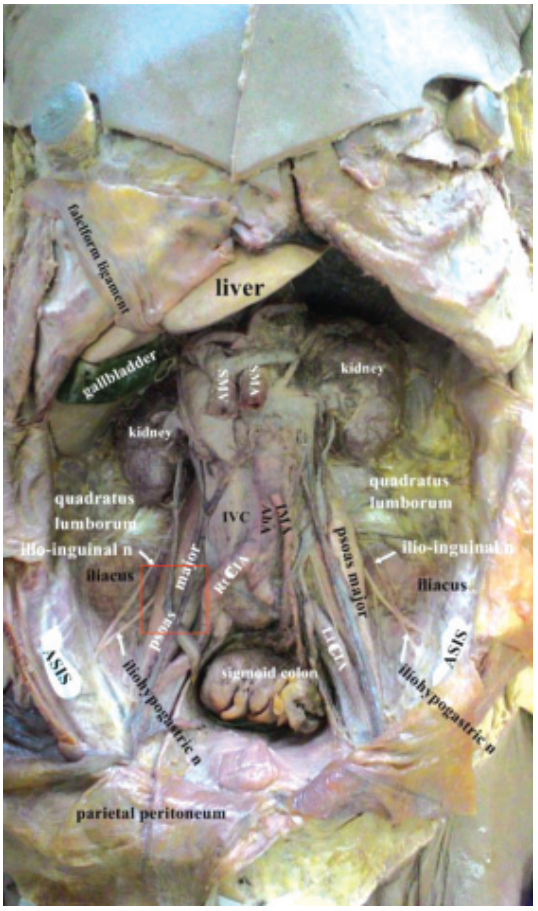

Figure 11 Deeper dissection of an abdomen showing the location of RW and RN corresponding to right common iliac artery (Rt. CIA). ASIS, anterior superior iliac spine; IMA, inferior mesenteric artery; Lt. CIA, left common iliac artery; PS, pubis symphysis; SMA, superior mesenteric artery; SMV, superior mesenteric vein; X, xiphoid process.

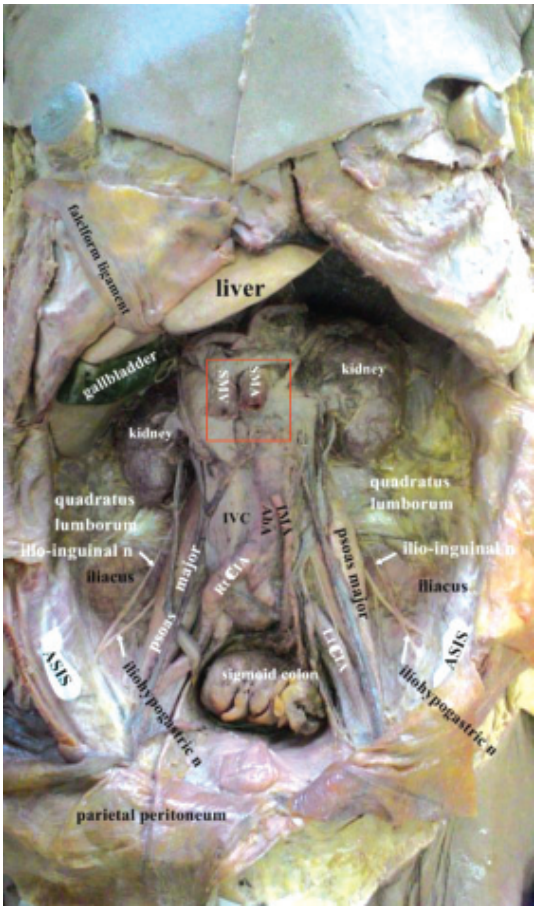

Figure 12 Deeper dissection of an abdomen showing the location of EP corresponding to the abdominal aorta and lie behind the superior mesenteric vessels. ASIS, anterior superior iliac spine; IMA, inferior mesenteric artery; Lt. CIA, left common iliac artery; PS, pubis symphysis; Rt. CIA, right common iliac artery; SMA, superior mesenteric artery; SMV, superior mesenteric vein; X, xiphoid process.

and Table 3) and anterior to the iliopsoas and iliacus muscles. This was confirmed by pressing on this point in volunteers, which caused a decrease in the dorsalis pedis arterial pulse.

LW and LN were located on the jejunum, where the superior mesenteric vessels distributed blood supply to this area. After dissecting deeper, the point was located at the left common iliac vessels and lay below the bifurcation of AbA (Table 3). The practice confirmation and the results of these points were similar to RW and RN.

EP in the volunteers corresponded to the structures ordered from superficial to deep level in cadavers as follows, the stomach body

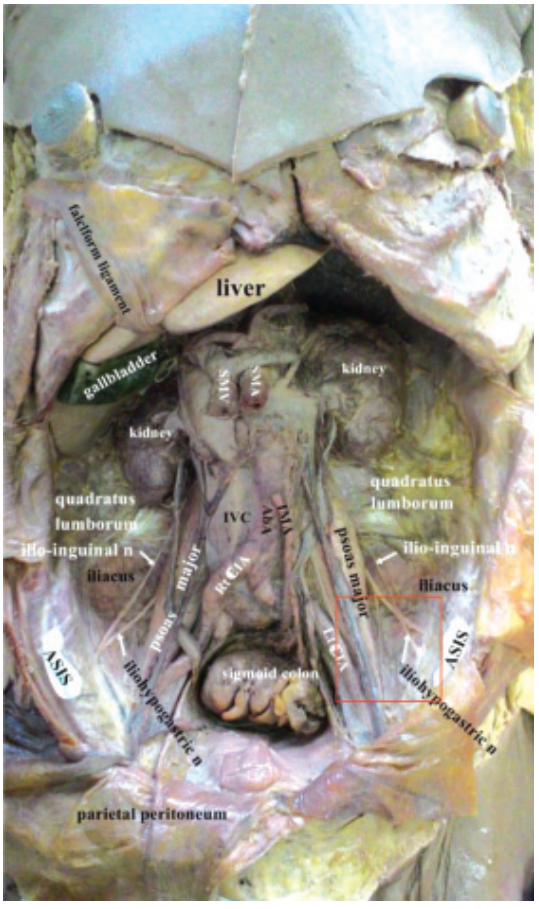

Figure 13 Deeper dissection of an abdomen showing the ASP2 corresponding to the iliohypogastric and ilioinguinal nerves emerged from the lateral border of the psoas major muscle. ASIS, anterior superior iliac spine; IMA, inferior mesenteric artery; Lt. CIA, left common iliac artery; PS, pubis symphysis; Rt. CIA, right common iliac artery; SMA, superior mesenteric artery; SMV, superior mesenteric vein; X, xiphoid process.

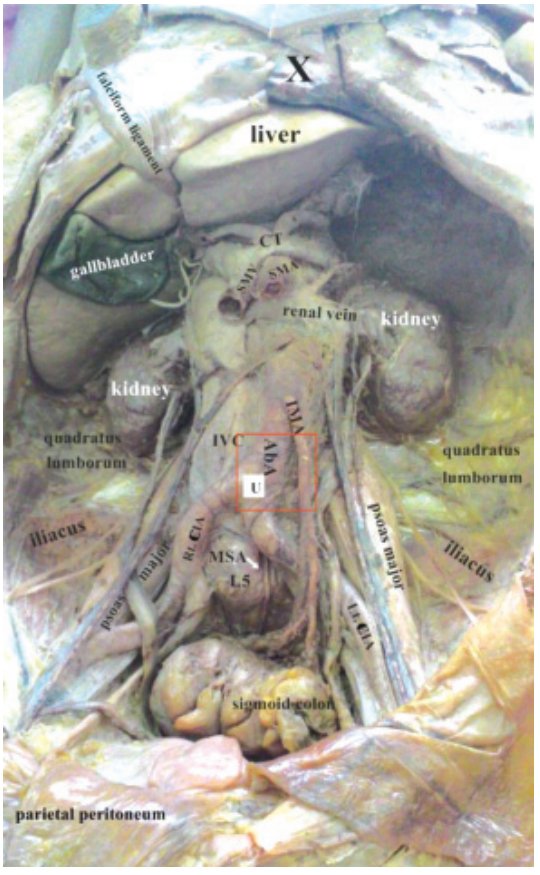

Figure 14 Deeper dissection of an abdomen showing the location of *Perd Pratu Lom* point (ASP5) corresponding to the bifurcation of the abdominal aorta and median sacral artery lay below the bifurcation. ASIS, anterior superior iliac spine; IMA, inferior mesenteric artery; Lt. CIA, left common iliac artery; Rt. CIA, right common iliac artery; SMA, superior mesenteric artery; SMV, superior mesenteric vein; U, umbilical point; X, xiphoid process.

and transverse colon, the trunk of superior mesenteric vessels, the AbA and the vertebral body of T7 level. The practice confirmation and the results of this point were similar to those mentioned above (Figure 12 and Table 3).

Points considered to be both MPs and SPs

The ASP1 and ASP2 in the volunteers were located at the Rt. and Lt. upper border of ASIS, respectively. In cadavers these points were located at the Rt. and Lt. lumbar region of abdomen. The layers of ASP1 ordered from

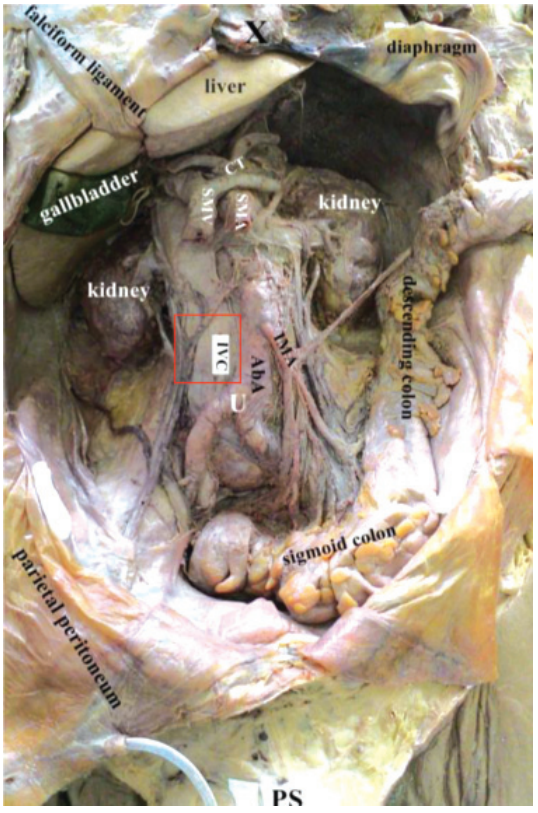

Figure 15 Deeper dissection of an abdomen showing the location of ASP3 corresponding to the superior mesenteric vein (cut) lie in front of the IVC. IMA, inferior mesenteric artery (cut); PS, pubis symphysis; SMA, superior mesenteric artery; IVC, inferior vena cava; SMV, superior mesenteric vein; U, umbilical point; X, xiphoid process.

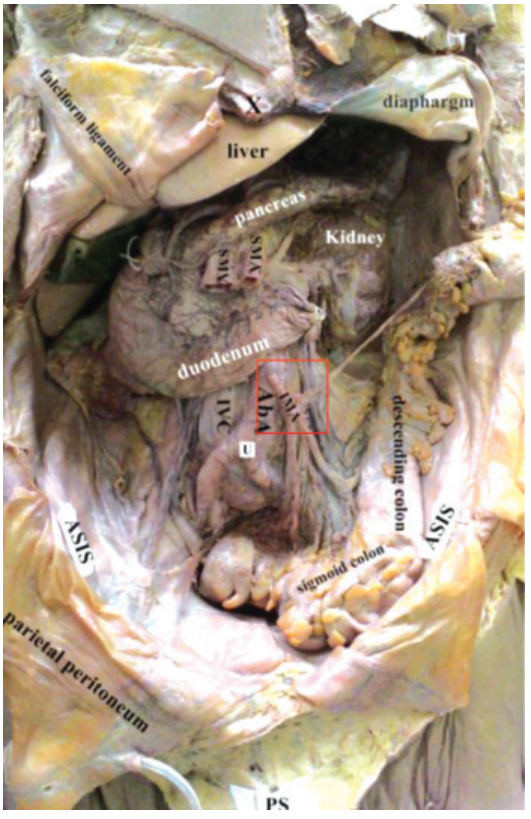

Figure 16 Deeper dissection of an abdomen showing the location of ASP4 corresponding to the SMA (cut) lie in front of the AbA. AbA, abdominal aorta; IMA inferior mesenteric artery; IVC, inferior vena cava; SMA, superior mesenteric artery; SMV, superior mesenteric vein; U, umbilical point; X, xiphoid process.

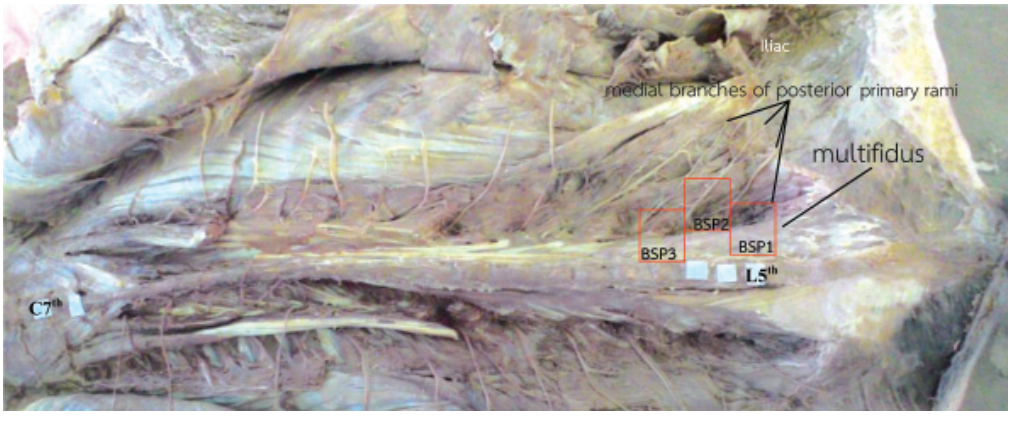

Figure 17 Deeper dissection of the back showing the location of BSP1 to BSP3 corresponding to posterior rami of spinal nerve emerged from the lateral border of multifidus lumborum. C7th, 7th cervical spinous process; L5th, 5th lumbar spinous process.

Figure 18 Deeper dissection of the back showing the location of BSP4 and BSP5 (both sides) corresponding to the posterior rami of spinal nerves emerged though the rotator thoracis. C2, 2nd cervical spinous process; C7, 7th cervical spinous process; T1, 1st thoracic spinous process.

superficial to deep were ileocecal part, caecum, ascending colon, iliohypogastric and ilioinguinal nerves, between the lateral border of psoas major and quadratus lumborum muscles, respectively. In ASP2 the layers were similar to ASP1, except this point was jejunum, descending colon, the inferior mesenteric vessels distributed to supply this area (Figure 13 and Table 3).

In volunteers, after applied the force on *Poed Pratu Lom* (ASP5; เปิดประตูลม) point corresponded to the structures ordered from superficial to deep layers as follows; jejunum, SMA and it branches, inferior mesenteric gangion and plexus, bifurcation of AbA, median sacral artery (MSA) and the anterior surface of vertebral bodies L3-L4 level, respectively (Figure 14 and Table 3). This was confirmed by pressing on this point in volunteers, which resulted in the dorsalis pedis arterial pulse.

The signaling points

In the volunteers, ASP3 and ASP4 palpated at the umbilical region. ASP3 in cadavers showed superficial to deep structures as follows. - transverse colon, middle colic vessels, SMV, IVC and vertebral bodies L1-L2 level (Figure 15). In ASP4 the structures were ordered identically as ASP3: transverse colon, middle colic vessels, IMA (Figure 16), inferior mesenteric ganglion, AbA and vertebral bodies L1-L2 level (Table 3). This was confirmed by pressing on ASP4 in volunteers, which decreased in the dorsalis pedis arterial pulse.

In the volunteers, the back SPs (BSP) palpated at the area lateral to spinous process 1 fingerbreadth on both sides from caudal to rostral position; BSP1-3 and BSP4-5 correspond to spinous process L5-L3 level and spinous process T1-C7 level, respectively.

In cadaver BSP1 to BSP3 showed superficial to deep structures as follows. - thora-

Table 3 Comparison between the BLs, MPs and SPs in the volunteers and the structures in the cadavers.

		Cadaver anatomical structures		
Lines /points	**Participants (percussion. auscultation and palpation)**	**1st (superficial) layer**	**2nd (intermediate) layer**	**3rd (deep) layer**
BLs				
RWL and RNL	tympanic percussion, bowel sound (auscultation)	ileum, transverse colon and the body part of stomach	SMV	IVC
LWL and LNL	tympanic percussion, bowel sound (auscultation)	jejunum, transverse colon and the body part of stomach	SMA	AbA
LB	paravertebral muscle (palpation)	superficial muscles of the back	deep muscles of the back	segmental arteries and the posterior rami of spinal nerve
LS	upper part of Trap (palpation)	Trap and LeS	Sup	SuN
MPs				
RW and RN	tympanic percussion, bowel sound (auscultation)	ileum	right common iliac vessels	– iliopsoas and iliacus muscles
LW and LN		jejunum	left common iliac vessels	
EP		stomach and transverse colon	superior mesenteric vessels	AbA
SPs				
ASP1*	tympanic percussion, bowel sound (auscultation)	ileocecal part	caecum and ascending colon	iliohypogastric and ilioinguinal nerves
ASP2*		jejunum	descending colon	
ASP3		transverse colon	SMV	IVC
ASP4		transverse colon	SMA	AbA
ASP5 or *Peod Pratu Lom**		jejunum	SMA	bifurcation of the AbA
BSP1	paravertebral muscle	erector spinae	multifidus lumborum	the emerging points of posterior rami and segmental lumbar arteries
BSP2	paravertebral muscle	erector spinae	multifidus lumborum	
BSP3	paravertebral muscle	erector spinae	multifidus lumborum	
BSP4	–	Trap	the aponeurotic origins of seratus posterior	splenius muscle, the emerging points of posterior rami and segmental thoracic arteries
BSP5	–	Trap	the aponeurotic origins of seratus posterior	

*Points considered to be both MPs and SPs

columbar fascia, aponeurotic origin of erector spinae, multifidus lumborum and the emerging points of posterior rami of spinal nerves divided into lateral and medial branches and the entering points of segmental of lumbar arteries to supplied multifidus lumborum (Figure 17 Table 3).

BSP4 and BSP5 lie in the rostral line of LB therefore, the anatomical structures were similar to the three layers of LB and LS (Figure 18 Table 3).

Discussion

This is the first investigation of anatomical land marks and structures in BLs, MPs and SPs of the trunk on both human and cadavers. There are several importance lines and points in the trunk that are important in practical CTTM for therapeutic massage. CTTM is an alternative treatment that has been widely recognized in Thailand[1-2, 5, 11-14, 17-20] to reduce musculoskeletal symptoms such as to decrease pain intensity, decrease muscle tension or spasm, increase range of motion in joint stiffness, increase blood and lymph circulation and relaxation. In this study, the surface landmarks for all BLs, MPs and SPs in the trunk resembled those in CTTM text book and known in clinical practice[1, 7-8]. Knowledge of the anatomical structure layers correlated with BLs, MPs and SPs including the force pressure were needed.

The present work found that the anatomical structures in the abdominal region underneath BLs, MPs and SPs were mainly organs of the gastrointestinal (GI) system with their associated vessels. In addition to those, the large vessels such as AbA, IVC and body of vertebrae were also found. There were different parts of the organs and structures in both Rt. and Lt. side or upper and lower area or superficial and deep layers of abdomen. Therefore, the effectiveness of CTTM treatment in CTTM disease depend on the location of massage, anatomical structures, and force pressure in each region of abdomen.

The *Dan Lom* disease is caused by chronic constipation or dyspepsia and showing abdominal distension from flatus and impact feces[1, 11-12]. Massage treatment of BLs, MPs and SPs alleviated symptoms in the GI system, increased movement of the intestine especially in the large intestine and also increased of blood and lymph circulation[1, 11-12]. All of lines and points of this treatment corresponded with the effected anatomical structures in cadavers.

The *Dan Leuat* patients suffered from pain during menstruation (dysmenorrhea). It was commonly a menstrual blood clot problem and associated palpated nodule at 1 fingerbreadth lower border of the umbilical point[1, 11-12]. The pain in normally in the neck, back, pelvis or lower border of the umbilical

point. CTTM practice in these patients involves massaging ASP1, ASP2 and ASP5 in the abdomen for pain releaf, decreasing muscle tension, pelvic muscles relaxation and increasing blood flow into the pelvis[1, 11-12]. The structures correlated with ASP1 and ASP2 were the iliohypogastric and ilioinguinal nerves which innervated internal oblique and transversus abdominis muscles and received sensory information from skin over the pelvic region, mons pubis, labia major and upper medial thigh. Furthermore, ASP5 is located at the bifurcation of AbA and one of those bifurcations lead to the internal iliac artery that supplied the pelvic organs[21].

For the back area, BLs and SPs were established to be mostly muscular structures with associated their vessels and nerve branches. There were shown to be similar and symmetrical structures in both sides of the back.

Asymmetrical of paravertebral muscle atrophy (ipsilateral or bilateral) atrophy and loss of general sensation were shown in *Lom Prap* disease[1, 11-12]. Thus, the back region was massaged following all of the BLs and SPs for relaxation and increased blood flow. According to all of LB and BSPs are located at the emerging points of the posterior rami and segmental arteries that supplied the paravertebral muscle.

The back region can be divided into upper and lower likewise *Lom Plai Pattakhat* disease of CTTM. The BSP1 and BSP3 *Lom Plai Pattakhat* are relevant to lower back pain. While BSP4 and BSP5 *Lom Plai Pattakhat* are relavant to upper back pain. There were several cause of these diseases such as damage through accident, poor physical conditions, habitual poor posture and poor body position, emotional stress, overload by work and musculoskeletal degeneration that gave rise to reginal or localization pain with referred pain[1, 9, 11-12]. Generally, BSP1 and BSP3 *Lom Plai Pattakhat* diseases produced lower back pain and radiated to the lower extremity associated with fatigue, muscle weakness and loss of plantar sensation. The nodule of muscle contrac-tion knot could be palpated at the lower back[1, 11-12]. Moreover, BSP1 and BSP3 are localized as the most common sites of myofascial trigger points (MTrPs) which caused a musculoskeletal pain disorder[22]. Thus, the back was massaged followed by the SPs, particularly in BSP1 or BSP3. The pressure application to these points related to the mechanics of massage pressure which pass directly through the key muscles as erector spinae and multifidus lumborum, including posterior rami of spinal nerves and segmental lumbar arteries, respectively as presented in this study[23] to increase relaxation and released tension within muscle fibers and break down the taut knot by endorphin re-

leasing and improving blood flow[24-26].

BSP4 and BSP5 *Lom Plai Pattakhat* diseases have they been described to affect the upper back, shoulder, neck pain, muscular knot palpation, limited cervical range of motion, and pain radiated to the supoccipital and temporal region together with tension headache and blurred vision[1, 11-12]. The radiating pain referred to only the upper extremity when the patient located pain in shoulder region. The patterns of pain and referred pain of this disease are similar to those of the common clinical syndrome of myofascial pain in the neck and shoulder regions[25, 27-29]. Previous studies have shown that the most frequent site of MTrPs was in the upper trapezius muscle (95.83%) and referred pain from this muscle may spread ipsilaterally from the posterior-lateral region of the neck (behind the ear) to the temporal region[29-32]. In this work, the anatomical structures according to BSP4 and BSP5 points were muscles of the back which originated from thoracic vertebral level to cervical vertebral level or from the occipital bone for example trapezius, rhomboid, levator scapulae, serratus posterior superior, cervical and capital parts of erector spinae, splenius capitis and semispinaris capitis[21, 30]. Additionally, the emerging points of posterior rami of spinal nerves and the segmental arteries were also found in these points. Therefore, CTTM on these two points which covered all muscles with MTrPs may break down any MTrPs adhesions, increase body flexibility, improve the range of joint motion, reduce ischemia and increase blood flow to allow decreased MTrPs sensitivity[20, 31-32].

The causes and symptoms of BSP1 and BSP3 *Lom Lam Bong* were similar to BSP1 and BSP3 *Lom Plai Pattakhat* except it could be palpated the muscle inflammation at BSP1 or BSP3, respectively[1, 11-12]. Thus, massage therapy at these two points according to lumbar part of back muscles can result in declined pain, stimulated blood and lymph circulation through exerting pressure on the skin and muscles as a results of enhanced nutrients flow to tissue and improved discretion of toxin or residual substance inside the body[18]. In addition to CTTM practice guidelines, ASP3 to ASP5 are massaged extraordinarily in excess of the CTTM practical guidelines then there was a decrease in inflammation and distributed blood flow into the back region[1, 11-12]. This study revealed the anatomical structures at ASP3 and ASP5 corresponded to AbA in the deepest layer which give rise to lumbar arteries that supplied deep muscles of the back such as erector spinae lumbolum and multifidus lumborum[21, 30].

For distribution of blood flow into the internal reproductive organs and relaxation of muscles in pelvic floor disorder, the point

of trunk as ASP1, ASP2, ASP5, BSP1, and BSP3 were massaged. Particularly at ASP5, the importance structure relating to this point in this work was bifurcation of AbA that branched into the internal iliac arteries to supply reproductive organs in the pelvis. Pelvic floor disorders caused by too much relaxation of muscle can produced back pain, problems urinating or having a bowel movement, and painful intercourse in female and tension of muscles causing problems with storing or emptying bowels, as well as pelvic pain, painful intercourse, or erectile dysfunction in male[1, 11-12]. Hence, massaged therapy of lower back muscles lied deep to BSP1 and BSP3 were treated for decreased muscle tension and increase local blood flow.

Conclusions

This study demonstrated the anatomical surface landmarks and structures that lie beneath BLs, MPs and SPs of the trunk in CTTM. These were helpful to identify structures and determine the benefits and responses of each line or point. Importantly, information from this work to be used the indicate cautions and contraindications during massage on the abdomen and back regions in clinical practice and should be valuable in establishing standard practice guidelines for CTTM.

Acknowledgments

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