



Variation of the Pectoralis Abdominis Muscle in Humans and its Comparative Anatomy in Primates

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ABSTRACT

During routine dissection in the Gross Anatomy Laboratory at the University of Indianapolis, a donor was found with a variation of a muscle of the shoulder, the pectoralis major, in which an extra strip of muscle was discovered along its inferior border. While not usually present in humans, many other primates are known to have a distinct muscle in this area called the pectoralis abdominis. This distinct muscle differs in its presence among primates, with highest frequencies in monkeys and lowest frequencies in apes. Using a comparative anatomy approach, this human muscle of interest was identified as a possible evolutionary remnant of pectoralis abdominis. Upon further dissection of the donor, their muscle also presented with a unique partial attachment to the long head of biceps brachii muscle. Knowledge of this anomaly is particularly relevant to clinicians that must fully understand the muscle morphology before performing shoulder surgeries. Furthermore, this study demonstrates that in humans this muscle may attach to nearby muscles, which is of significance for common surgeries that involve the pectoralis major and biceps brachii muscles. Not only does this highlight that awareness of muscular variation is critical to clinicians, this study also showcases the evolutionary origin of this muscle and the close relationship we share with our primate cousins.

INTRODUCTION

Anatomy of Pectoralis Major Muscle

The **pectoralis major (PM)** is a large bilateral muscle of the shoulder that helps to flex, internally rotate, and adduct the arm [1]. This thick, fan-shaped muscle is located deep to the breast tissue in the anterior trunk. In normal anatomical presentation, humans consistently have two distinctive heads of the PM: (1) clavicular head, (2) sternocostal head. A third part often extends inferiorly from sternocostal head, creating an abdominal portion (AP) (see Figure 1).

- **Origins:**
 - Clavicular head (CH) → medial half of the **clavicle**
 - Sternocostal head (SH) → anterior surface of the **sternum**, **costal cartilages of ribs 1-7**, & **rectus sheath**
- **Insertion:** near **intertubercular groove** of the **humerus**

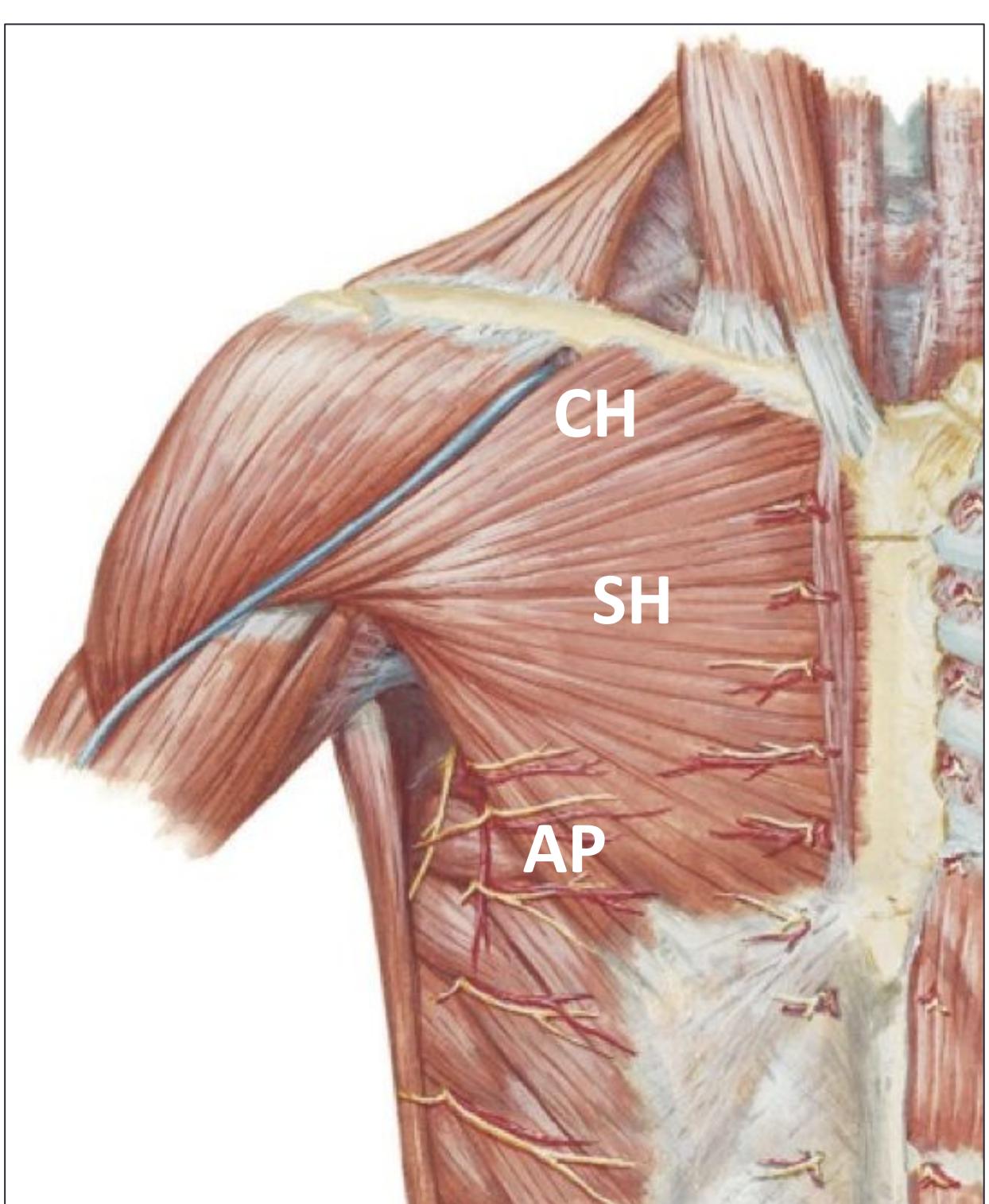


Figure 1: Typical morphology of pectoralis major muscle in humans (image courtesy of Netter).

Case Presentation

During dissection in the Gross Anatomy Lab, a donor was found with a variation of the PM, with a distinct abdominal portion attaching only to the rectus sheath. From the naked eye this anomaly appeared to be its own distinct muscle because it was not completely fused to the sternocostal head of PM. This study seeks to explore:

1. **Why is this extra strip of muscle present?**
2. **What clinical relevance does it have?**

In order to learn more, this study takes on a comparative anatomy approach to see if this distinctive abdominal portion exists in other primates.

EVOLUTIONARY HISTORY

Across different primates in varying frequencies, there is a prevalence of the abdominal portion being its own distinct muscle: the **pectoralis abdominis (PA)** (see Figure 2), which is also referred to as pectoralis abdominalis or pectoralis quartus. Among primates, this muscle is found most frequently in **all monkey species and gibbons** [2,4]. The function of this muscle in most primates is similar to pectoralis major, as it also adducts and internally rotates the arm [5]. When present, PA is located inferiorly to the PM muscle, with different attachments:

- **Origin:** **rectus sheath**
- **Insertion:** crest of greater tubercle of the **humerus**

The pectoralis abdominis has also been observed in other primates, including gorillas, but is most rarely found in orangutans, chimpanzees, and humans. When present, the PA differs from monkeys and gibbons in that it instead appears to insert on nearby muscles or another bone (the scapula) (see Table 1).

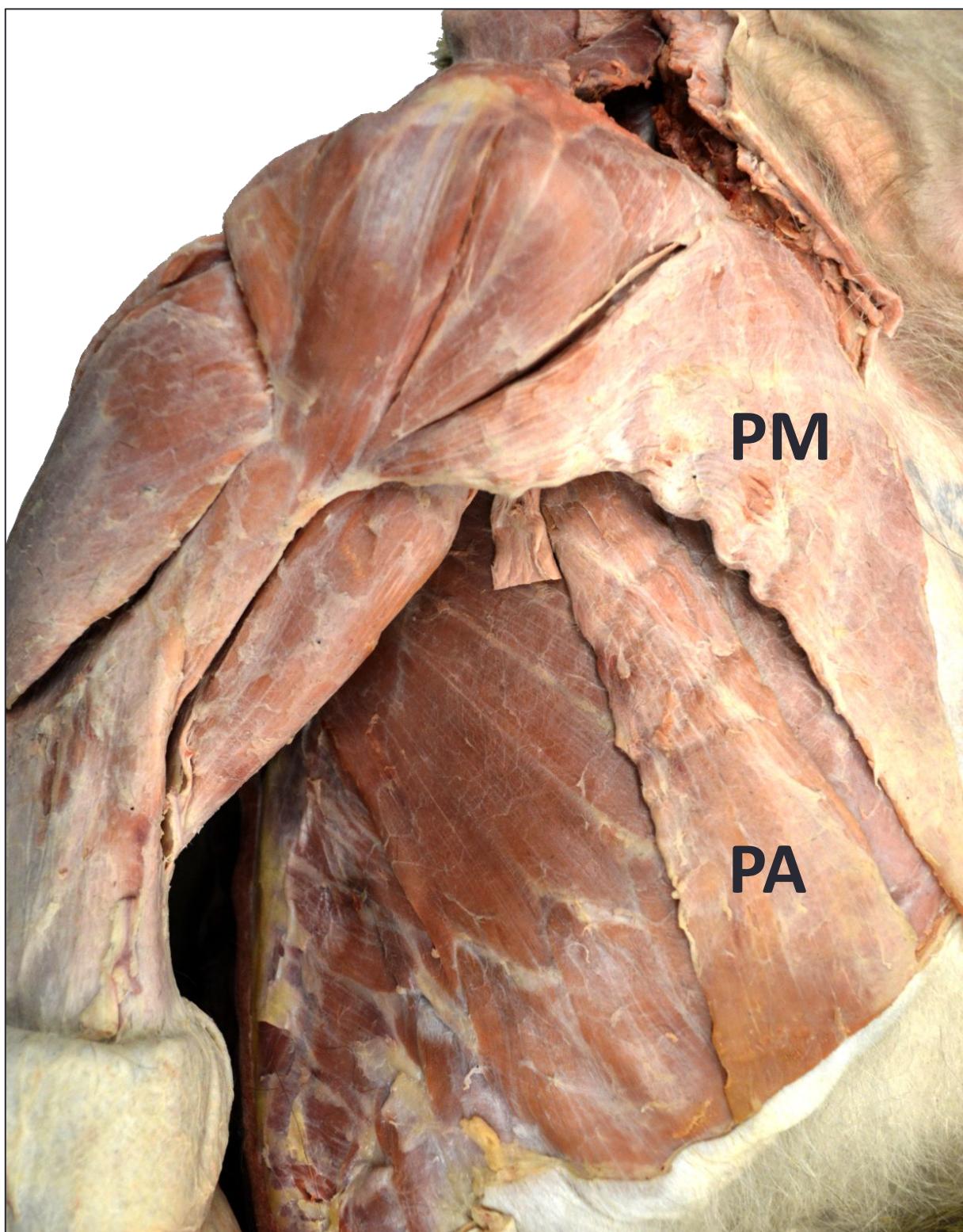


Figure 2: Macaque monkey with pectoralis abdominis (PA); PM = pectoralis major. [5]

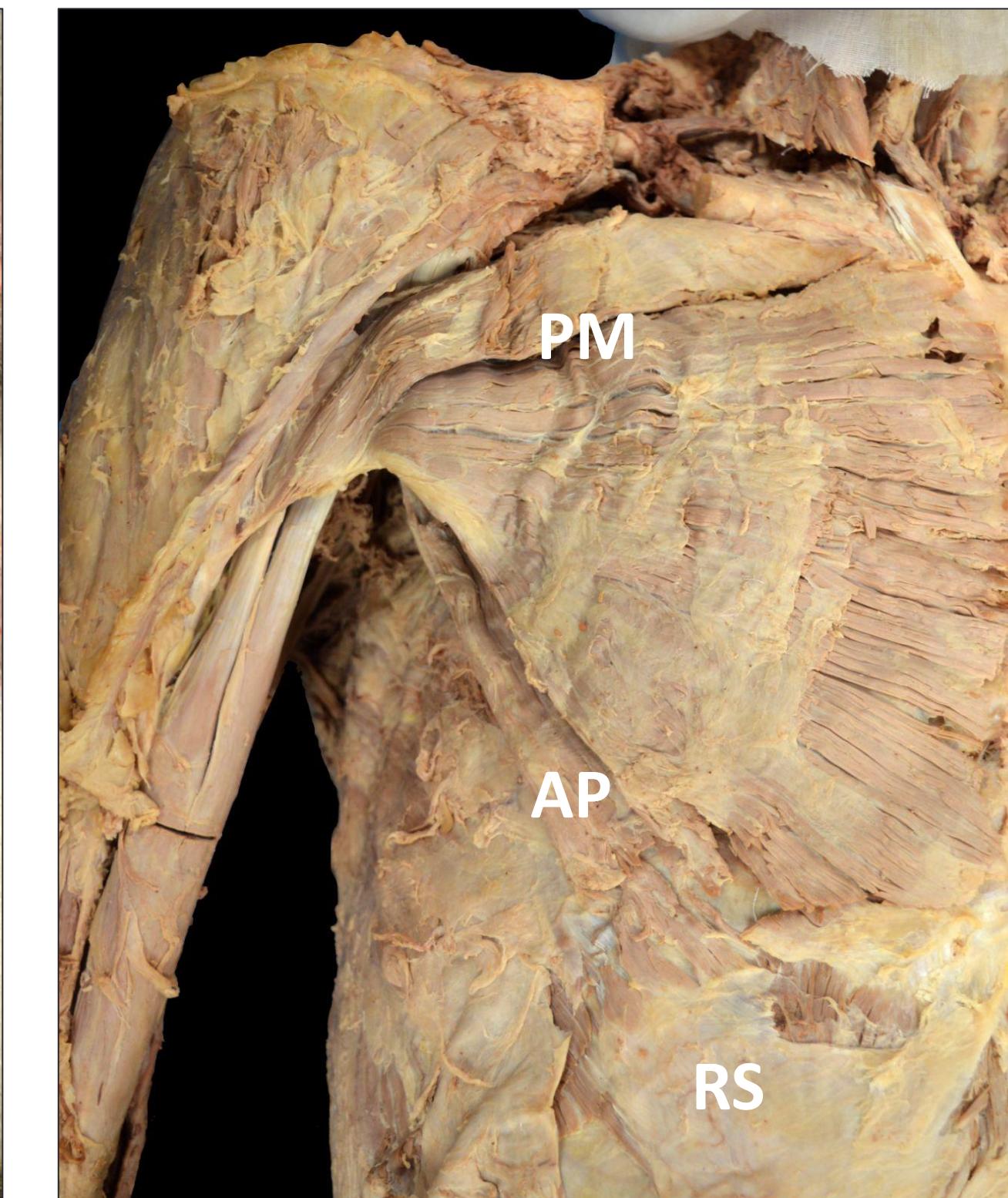


Figure 3: Human donor from Gross Anatomy Lab, which distinct abdominal portion (AP); RS = rectus sheath. [5]

Table 1: Prevalence of the pectoralis abdominis (PA) across primates.

Primate	Frequency of PA	Insertion on:
Monkey [5, 9]	highest	humerus (greater tubercle)
Gibbon [4, 11]	highest	humerus (greater tubercle)
Gorilla [11]	high	scapula (coracoid process) or coracobrachialis muscle
Orangutan [11]	low	pectoralis major muscle
Chimpanzee [4, 11]	low	pectoralis major muscle
Human [11]	low	biceps brachii muscle

Until recently, only one human muscle resembling pectoralis abdominis has ever been recorded in detail as its own distinctive muscle apart from pectoralis major [11]. In this case, PA inserted on the short head tendon of biceps brachii muscle, near the coracoid process of the scapula [4]. Due to its similar origin but slightly differing insertion onto muscle rather than bone, this suggests that over time in humans (and great apes), the PA evolved to become part of pectoralis major muscle all primates possess.

Therefore, there is a high probability that the abdominal portion of muscle located inferior to pectoralis major is an evolutionary remnant of pectoralis abdominis.

RESULTS & DISCUSSION

Clinical Significance

Upon further dissection of the human donor in the Gross Anatomy Lab, it was discovered that the extra abdominal muscle attached to the pectoralis major near its bony insertion (see Figure 3). Interestingly, this muscle inserts onto the long head tendon of biceps brachii muscle (see Figure 4). This insertion is unique because most muscles attach to bones rather than other muscles. This is of particular interest because it could have clinical implications if there are more individuals with this kind of muscular anomaly.

In the shoulder, the long head of **biceps brachii (BB)** muscle is particularly susceptible to tearing. In individuals with similar muscular insertions on this BB tendon, common surgeries such as release surgery (biceps tenodesis) and biceps tenotomy could also be impacted [6]. For example, if the long head tendon of BB is displaced in any way, there could be an increased risk of pain, discomfort, and weakness of shoulder movement, especially if another muscle is attaching to this tendon. This could potentially prevent a patient from doing normal daily tasks.

In summary, due to the location and similar attachment points of the abdominal portion of pectoralis major, this suggests that the extra strip of muscle is a potential remnant of pectoralis abdominis muscle.

Future Research

In the future, more research should focus on exploring if more humans have abdominal portions of the pectoralis major inserting onto another muscle, particularly if it attaches to the long head tendon of biceps brachii muscle.

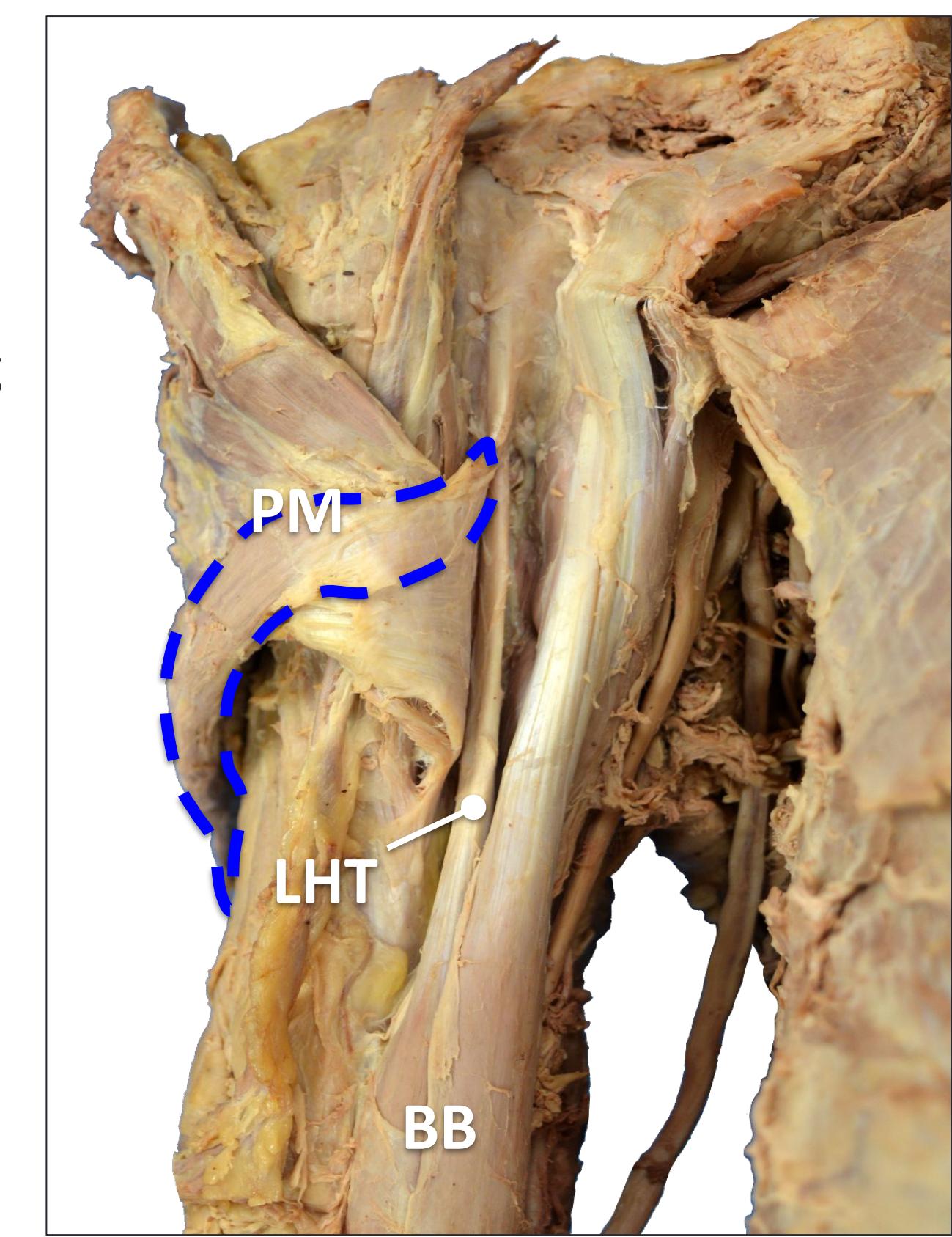


Figure 4: Pectoralis major (PM) reflected to view insertion of abdominal part (dotted line) on long head tendon (LHT) of biceps brachii (BB).

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