

Montgomery Glands in the Areolar Region: A Clinical Overview

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ABSTRACT

Objective: In his 1837 book on signs and symptoms of human pregnancy, William Montgomery described the tubercles (glands) in the areolar region of women, now eponymously identified with his name. As themes such as lactating man, pregnancy of transgender men, nipple-areola complex (NAC) enhancement in plastic surgery and nipple sparing mastectomy for women breast cancer patients have gained recognition, a clinical overview and questions needing resolution pertaining to Montgomery glands in the areolar region are presented.

Method: Scattered literature on Montgomery glands and its synonyms (Montgomery tubercles and areolar glands) located in PubMed database and pertinent commercial databases (SCOPUS, Wiley Online library, Springer link) was studied.

Commentary: Histological data generated by William Montagna and his colleagues on the Montgomery glands in adolescent girls and women, as well as reported pathologies in Montgomery glands are presented in two tables.

Conclusion: In opposing the view of West (1949) that Montgomery's name shouldn't be associated with the tubercles with which he is identified now, I'd infer that Montgomery did earn the eponymous tag for the areolar gland, for identifying them as a 'pregnancy marker'. Questions needing resolution pertaining to Montgomery glands include, (1) whether Montgomery glands are present in the areolar region of men? (2) If present, are they fully functional? (3) what is the chemical composition of Montgomery gland fluid?

KEY WORDS

breast reconstruction, lactation, William Montgomery, mastectomy, nipple-areolar complex, pregnancy

INTRODUCTION

Irish obstetrician William Fetherstone Montgomery (1797-1859) published his remarkable book '*An Exposition of the Signs and Symptoms of Pregnancy, the period of human gestation, and the signs of delivery*' in 1837. (Fig.1) What he had reported as

"In the centre of the coloured circle the nipple is observed partaking of the altered colour of the part and appearing turgid and prominent, while the surface of the areola, especially that part of it which lies more immediately around the base of the nipple, is studded over and rendered unequal by the prominence of the glandular follicles, which, varying in number from twelve to twenty, project from the sixteenth to the eighth of an inch..."⁽¹⁾

in the areolar region of the breast of pregnant women, came to be tagged with names – Montgomery tubercles or Montgomery glands or areolar glands. (Fig. 2)⁽²⁻⁹⁾ However, West⁽¹⁰⁾ was of the view that, "it is the name of Cooper, Meckel or Morgagni that should be associated with these tubercles rather than that of Montgomery, and indeed the name *tubercula Morgagni* is sometimes given to the elevations caused by the areolar glands." [Italics, as in the original.]

Now that, themes such as lactating man^(11,12), pregnancy of transgender men⁽¹³⁻¹⁵⁾, nipple-areola complex (NAC) enhancement in plastic surgery⁽¹⁶⁾ and nipple sparing mastectomy for women breast cancer patients⁽¹⁷⁾ have gained recognition, a clinical overview and questions needing resolution pertaining to Montgomery glands are presented here.

METHOD

Scattered literature on Montgomery glands and its synonyms (Montgomery tubercles and areolar glands) located from PubMed database and pertinent commercial databases (SCOPUS, Wiley Online library, Springer link) was studied.

COMMENTARY

British anatomist Astley Cooper (1768-1841), whose pioneering study on the anatomy of the breast was published an year before his death, was of the opinion that Montgomery's tubercles do not release milk, and "*They are, only mucous glands, formed to lubricate the nipple and areola, and to defend them from the friction of the child's lips, and the irritation of its secretions.*"⁽¹⁸⁾ Interestingly, Cooper do not mention Montgomery, by name specifically, though Montgomery's book was published only three years before his own book [*On the Anatomy of the Breast*]. Can this be considered as an early case of 'citation amnesia'? One may surmise this omission due to professional rivalry and competition between the natives of Ireland (Montgomery) and Britain (Cooper). This view is partially supported by a recent profile of Cooper by Burch, which indicates 'Astley Paston Cooper was vain, egotistical, nepotistic and had a capacity to inflict pain that verged on sadism.'⁽¹⁹⁾

While presenting his histological study of the 'normal mamma in relation to tumor growth' in 1934 and 1935, Dawson^(20,21) had negated the presence of Montgomery's tubercles in women as follows:

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Table 1: Summary of histological data on Montgomery glands (tubercles) by Montagna and his colleagues

Study sample	Findings	Reference
fresh surgical specimens of 8 subjects, 35- 65 yr	There is some confusion about the identity; but, tubercles are rudimentary mammary glands	Giacometti and Montagna ²²⁾
tissues, few hours after accidental death of subjects. boys and girls, 8-12 yr; adolescents of both sexes, 14-18 yr; women, 23-79 yr.;man, 21 yr.	1. tubercles are accessory mammary glands. 2. tubercles are usually surrounded by nerves.	Montagna ²³⁾
Tissues few hours after accidental death of subjects 12 women, aged 14, 23, 31. 34 and 49	1. glands are neither small nor total breast tissue. 2. size and conspicuity of cells varies with each individual. 3. glands become functional during lactation and milk can be expressed from them.	Montagna and Yun ²⁴⁾
[not described]	1. galactophores are found in loose groups of 3-6, arranged in various patterns. Some form a circle around a large sebaceous gland. Few grow singly.	Montagna and Macpherson ²⁵⁾

Table 2: Reported Pathologies in Montgomery's Gland

Age of women patients*	Location	Pathology	Reference
64	Japan	proliferation of Montgomery gland cells, intermingled with Paget cells.	Sekiguchi ²⁶⁾
32	USA	chronic infection	Sugg ²⁷⁾
12-14	Canada	spontaneous nipple discharge, breast lumps	Watkins <i>et al.</i> ²⁸⁾
21	Germany	relapsing inflammation	Bleach <i>et al.</i> ²⁹⁾
38	Japan	intraductal papilloma, bloody discharge	Sakai <i>et al.</i> ³⁰⁾
30	USA	sub areolar abscess with pain and erythema of areola	Da Costa <i>et al.</i> ³¹⁾
15	UK	retroareolar cysts	Wallace <i>et al.</i> ³²⁾
13-15	Saudi Arabia	cysts	Almuhanna <i>et al.</i> ³³⁾

* in years

"I have been unable to identify these structures, in an examination of a very large number of whole breast sections with the overlying skin. They are described by Lewis and Bremer, for example, as 'branched tubular glands with a lactiferous sinus and otherwise resembling the constituent mammary gland ... they surround the nipple as small elevations and become much more prominent in pregnancy, when an oily secretion is produced.' Such appearances, are, in my opinion, produced by normal or hypertrophied sebaceous glands, found in abundance in and around the nipple area."²⁰⁾ [dots, are as in the original.]

"hypertrophy of the large sebaceous glands of the nipple and areola — the so-called Montgomery's tubercles — is described as present during pregnancy and lactation, but my sections do not show these structures as particularly prominent."²¹⁾

Why Dawson couldn't 'identify' Montgomery's tubercles? It is my conjecture that his study specimens might have been, what I call 'conditionally abnormal or diseased' The very first sentence of Dawson's

paper offers clue to this conjecture. It was, "Much of the tissue on which this study of normal and pathological growth in the breast is based was collected by Dr James W. Dawson as material for his intended investigation of mammary tumours."²⁰⁾ Dawson had failed to provide additional details on the tissue collection procedures, and the collector of the tissue was not self, but another individual (probably a kin?).

We had to wait for another 35 years to positively confirm the histological identity of Montgomery's glands, via the incisive reports published by Italian-American dermatologist William Montagna (1913-1994) and his colleagues. Montagna, with a Ph.D in Zoology, was affiliated to the Brown University of Rhode Island in 1950s, and later at the Oregon Regional Primate Research Center.²²⁻²⁵⁾ Table 1 summarizes the histological data generated by Montagna and his colleagues on the Montgomery glands in adolescent girls and women. The merit in these studies²²⁻²⁴⁾ was, that the surgical specimens were collected few hours after accidental deaths of subjects, and can be assumed to be of normal configuration. Subsequently, Smith *et al.*⁷⁾ had published their histological observations on Montgomery's tubercles by light microscope. But, their specimens were obtained from 12 postmenopausal women (age range 46 to 72 yrs.) who had undergone radical mastectomy after a diagnosis of infiltrating ductal adenocarcinoma of the breast. In this specific sample of breast cancer patients, the number of tubercles identified by Smith *et al.*⁷⁾ ranged between 1 to 5 per specimen, and 11 among the 35 tubercles (31%) showed identifiable lesions.

Montgomery's glands are also subjected to benign pathology due to blockage of its ducts.⁸⁾ Reported pathologies in Montgomery glands are presented in Table 2. These include proliferation of gland cells intermingled with Paget cell in an elderly woman²⁶⁾, chronic infection²⁷⁾, spontaneous nipple discharge and breast lumps in otherwise healthy, non-pregnant juveniles²⁸⁾, relapsing inflammation²⁹⁾, intraductal papilloma with bloody discharge and subareolar abscess with pain³⁰⁾, subareolar abscess with pain and erythema of areola³¹⁾ and cyst^{32,33)}. Del Riego *et al.*³⁴⁾ had clarified the muddled terminology (eponymous Morgagni and Montgomery) on tubercles present in areola, succinctly as "the small raised areas on the skin of the areola (1-2 mm) are called Morgagni tubercles. The tubercles are the openings of the ducts of the Montgomery glands, modified sebaceous glands that are connected to small, rudimentary mammary glands and can therefore secrete milk." This view is supported by Nicholson *et al.*³⁵⁾ as well. Despite such significance in medical pathology, Montgomery glands hardly receive a mention in popular books published on breasts by women authors!^{136,37)}

Lately, the relevance on the number and locations of Montgomery's glands have gained prominence in plastic surgery and medical tattooing for recuperating premenopausal and postmenopausal breast cancer patients.^{38,39)} One of the four innovative modifications of medical tattooing procedures in nipple-areola complex reconstruction presented by Sasaki and Matsumine³⁹⁾ was creating an illusion of Montgomery glands (areolar bumps) by sculpting polka dots pattern. According to these researchers, such a surgery was conducted between April 2014 and October 2016 on 56 women patients who underwent nipple-areola complex reconstruction at the Tokyo Women's Medical University. Required time for the procedure was about 30 minutes.

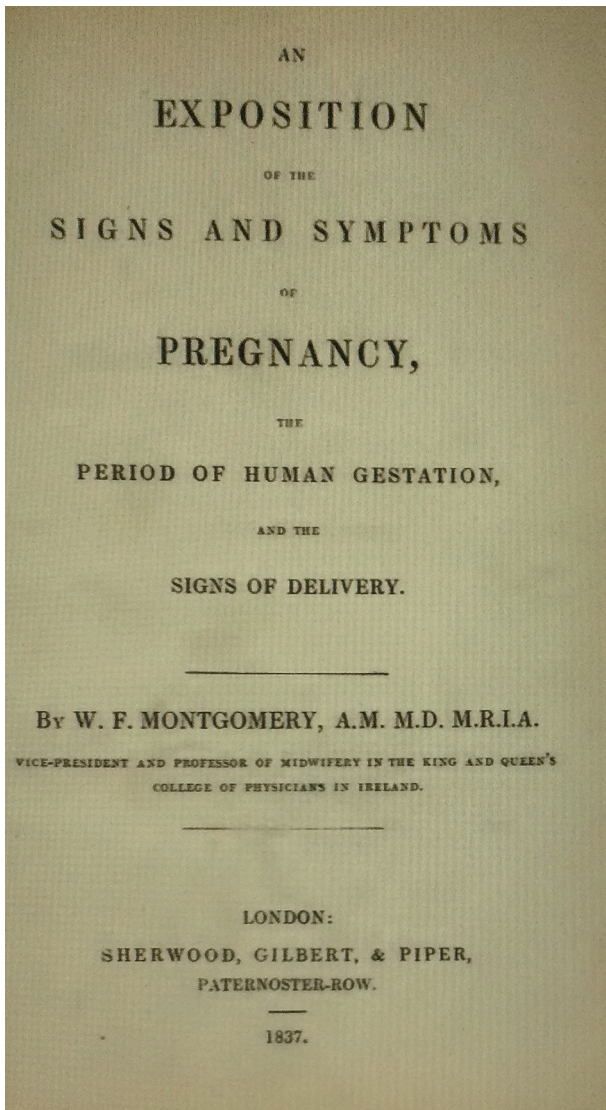


Figure 1: Title page of William Montgomery's book on Human Pregnancy (1837), published in London.

Furthermore, the importance of volatile secretions from the Montgomery glands in lactating mothers for bonding with their newborns have been studied in the lab of Benoist Schaal.⁴⁰⁻⁴² In a study consisting of 121 Caucasian mother-infant dyads, Doucet *et al.*⁴¹ found that 97% of mothers were endowed with the glands, and the number of glands varied from 1 to 20 per areola; also, the number of glands was unrelated to parity, breast side or to the newborn's gender. Though 185 years had passed since Montgomery's description, as of now the chemical composition of the secretions released from these modified sebaceous glands remain to be elucidated. A potential for identifying human pheromone(s) from such Montgomery gland fluid has been suggested by Wyatt^{43,44}. This was anticipated by Makin and Porter⁴⁵ in 1989, for a simple reason that nipple-areolar region is where milk, sebum and sweat secretions combine for the newborns to recognize and discriminate specific maternal odors.

CONCLUSION

In opposing the view of West¹⁰, presented in the introduction, I'd infer that Montgomery did earn the eponymous tag for the areolar gland, for identifying them as a 'pregnancy marker'. This is what Montgomery had written in 1837:

"we not unfrequently find that the little glandular follicles or tubercles, as they are called by Morgagni, are bedewed with a secretion sufficient to damp and colour the woman's inner dress. These changes do



Figure 2: Areolar region of a 19 year old female, with faintly visible Montgomery glands, as little 'goosebumps', indicated by four arrows. (copyright permitted under GNU Free documentation license; source https://commons.wikimedia.org/wiki/File:Female_Areola.jpg.)

*not take place immediately after conception, but occur in different persons after uncertain intervals: we must therefore consider, in the first place, the period of pregnancy at which we may expect to gain any useful information from the condition of the areola. I cannot say positively what may be the earliest period at which this change can be observed, but I have recognized it fully at the end of the second month, at which time the alteration in colour is by no means the circumstance most observable..."*¹¹)

After studying the paper of Stone and Wheeler⁹, I queried surgical oncologist Dr. Amanda Wheeler via email: 'I'd appreciate if you can let me know, whether Montgomery glands are present in men's nipples. If it has been reported, can you give me a reference citation?' I'm thankful for Dr. Wheeler's prompt response (received on Aug 26, 2015): "Interestingly enough I cannot find a reference for you. But Montgomery glands are thought to be found in men as well, but not as prominent. When I searched the internet there are anecdotal accounts of males with Montgomery glands that have become plugged just like a sweat gland. I wonder if plastic surgery has a reference? I will keep looking and ask one of my male plastic surgery colleagues. Thank you. Amanda"

Though 7 years have passed since then, few questions needing resolution pertaining to Montgomery glands include, (1) whether Montgomery glands are present in the areolar region of men? (2) If present, are they fully functional? (3) what is the chemical composition of Montgomery gland fluid? Current lacunae on the knowledge of nipple-areolar region and Montgomery glands of men, women and non-binary sex populations deserve notice⁴⁶ for a clear understanding of the welfare of newborn babies and their caregivers, whether they be women or men or of transgender sex type.

CONFLICT OF INTERESTS AND FUNDING

None declared.

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