EWMA · LONDON 2015

Submitted to EWMA Journal, Based on presentation given in the free paper session Wound Assessment.

The Fluorescent Diagnosis of Stoma Mucosa

FIRST TIME PRESENTER
EWMA
INTERNATIONAL AWARD 2015

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Conflicts of interest: None

ABSTRACT

The aim of this study was to explore the use of fluorescence technology to distinguish and explore different types of stoma mucosal lesions that often appear as healthy under white light. Fluorescence technology is a fast and non-invasive method for imaging tissue in many situations. Fluorescence technology is a very sensitive and specific technique useful in diagnosing small changes that are invisible using white lighting procedures. In stoma nursing care, this technique allows the clinician to view the nature of the mucosa concisely and detect aberrant tissues in detail. However, fluorescence technology is not widely practised.

METHODS

From June 2014 to May 2015, we examined 127 patients with stoma (colostomy or ileostomy) in the Wound and Stoma Clinic. Patients with Urostomy were excluded from this study. In addition to the standard examination by white light, stoma were examined with fluorescence. We used a fluorescent strip that was immersed in 10ml of 0.9% normal saline. The stained saline was applied to the stoma mucosa, then visualised with a microscope under blue light with a 10x objective. The resultant red-green image was evaluated for etiological changes not otherwise visible.

RESULTS

A variety of diagnoses were determined using the fluorescence technology despite the appearance of viable red stoma under white light. Stoma diagnoses were classified as mucositis, local ulceration, laceration, local bleeder, mucosal tear, and nothing abnormal.

CONCLUSIONS

Although a stoma may appear healthy under the naked eye, minor stoma complications may be overlooked. Fluorescence imaging technology is a user-friendly, non-invasive, and sensitive diagnostic tool for clinicians to examine stoma mucosal lesions and the underlying structures in a more detailed manner.

BACKGROUND

An intestinal stoma is the surgical opening through the abdominal wall for faecal or urinary diversion. The stoma is a part of the small or large bowel that can be seen protruding through the abdominal wall. A stoma is commonly indicated in operations for malignant colorectal cancers. Every patient needs to learn stoma and skin care for rehabilitation during recovery, whether the stoma is temporary or permanent in nature. During the rehabilitation period, patients may need to come back for stoma examination and rehabilitative care assessment in the clinic.

The risk of complications from stoma formation is life long, but the incidence of complications is highest in the first 5 years of the postoperative period. Complications are generally classified as early or late complications. Early complications include inappropriate location, skin excoriation, leakage, stoma retraction, dehydration, and stoma necrosis. Late complications include parastomal hernia, stomal prolapse, stenosis, and peristomal dermatitis[1].

The most frequent stoma complications can be classified as stoma-related or peristomal skin disorders. A study by Kalashnikovs et al. showed that among 1,427 patients, 533 patients had 742 stoma complications. Of the 742 stoma complications, 387 were stoma-related and 355 were peristomal skin disorders. The most frequent stoma-related complications were parastomal hernia (25%), mucocutaneous separation (19%), retraction (14%), prolapse (17%), and stenosis (10%). On the other hand, the most frequent peristomal skin disorder was contact dermatitis (89%)[2].

Complications resulting from a stoma undermine a patient's ability to manage their own care, prolong adaptation to the stoma, and lead to repeated hospitalisations[3]. Stoma nurses play an important role in assessing patient risks. The common practises that most stoma nurses focus on during a patient's visit to the clinic include determining if appliances leak, examining peristomal skin, and evaluating the paras-

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tomal condition, as well as physical rehabilitation. Surprisingly, about 65% of patients complain of stoma mucosal bleeding. However, stoma nurse specialists may not recognise the bleeding and may ignore minor symptoms. Minor bleeding from the exposed mucosa is thought to be inevitable, and most likely can be controlled by topical medications or direct pressure. However, stoma bleeding from mucous membranes can be a sign of mucositis [4,5]. Mucositis is an inflammatory process of the mucosa due to radiation or chemotherapy, characterised by atrophy of squamous epithelial tissue, vascular damage, and inflammatory infiltration concentrated at the basement region. Epithelial atrophy is followed by ulceration. Sites of mucositis are often covered by a fibrous-inflammatory (pseudomembranous) exudate[6].However, stoma mucositis may not be easily detected by the naked eye. Mucositis can occur anywhere along the digestive tract from the mouth to the anus, at different levels[4], and ranges from redness to severe ulceration[6].

Furthermore, inappropriate stoma pouching skills may cause mucosal injury or ulceration. When patients carelessly or incorrectly place the stomahesive base plate, the base plate edge can rub against the stoma and cause an abrasion at the stoma base. The resulting invisible lesion may lead to stomal bleeding or wound lesions.

Commonly, diagnostic tools in stoma nursing are rare. The stoma examination is limited to visual inspection and palpation of the stoma wound, and the peristomal and parastomal skin. Sometimes digital stoma examination may be indicated to diagnose a stenosis or to rule out faecal impaction in the general examination. On rare occasions, mini endoscopy with a lubricated test tube may be indicated to examine the level of stoma necrosis in the early postoperative period. Fluorescence is one of the first diagnostic tools allowing nurses to evaluate the stoma mucosa objectively. Stoma bleeding from the mucosa is one of the most frequent symptoms (about 75% in the patient group) among stoma patients in the clinic; however, stoma bleeding is often overlooked. Nurse practitioners do not actively determine why stoma bleeding occurs, because minor stoma bleeding is thought to be inevitable due to exposed friable mucosal tissue. Stoma bleeding is often asymptomatic, because bleeding eventually stops, even when clotting time is prolonged. Nurse practitioners often suggest observation and gentle stoma cleansing for easily controlled stoma bleeding, whereas topical silver nitrate may be indicated for persistent stoma bleeding. However, the causes and preventive measures for stoma bleeding have not been investigated. Stoma mucosa may be prone to bleeding due to exposure to air, inflammation and infection, repeated trauma, tearing, or inappropriate stoma care. Uncontrolled stoma bleeding may result in unnecessary hospital admissions and blood transfusion for massive bleeding. Visual examination with a torch can identify significant bleeders or injuries to the mucosa; however, fluorescence is an objective diagnostic tool to explore different stoma appearances even when a lesion is not visible. Fluorescence not only aids in accurately locating a lesion, but also aids in identification of mucosal ulceration to minimise the risk of stoma perforations.

WHAT IS FLUORESCENCE?

Clinically, fluorescence is commonly used in medicine and surgery. In ophthalmology, foreign bodies in the cornea, lacrimal tests, corneal abrasions or ulcers can be easily detected by fluorescence under a slit lamp. Neoplasms, tumours, and abnormal cells with extravasation can be easily observed in the gastrointestinal tract with fluorescence. In colorectal nursing, the use of fluorescence for stoma mucosa assessment is a new concept.

In many studies, fluorescence diagnostics have been described as very sensitive and specific, especially in diagnosing small changes that are invisible under white light endoscopic procedures. Fluorescence is generated by endogenous molecules, such as aromatic amino acids, nicotinamide adenine dinucleotide, or porphyrins[2]. Fluorescence is a fast and non-invasive method for imaging precancerous and cancerous tissues in many situations. This method has been discussed in a variety of applications in the fields of oncology, dermatology, laryngology, pulmonology, gynaecology, and gastroenterology[8].

Intestinal stoma assessment is often limited to visual examination and palpation. Endoscopy is occasionally needed to determine the level of stoma necrosis postoperatively and identify the need for emergency revision surgery. Stoma assessment should be performed in good light, and the use of a magnifying glass can be helpful. However, even with the assistance of a magnifying glass, only the surface structure of the mucosa can be seen by visual inspection under white light. Detailed examination by experienced stoma nurses is necessary to detect complications. In the clinical setting, the stoma mucosa may appear healthy, red, and moist, but have invisible signs and symptoms. Fluorescent diagnostics have evolved, and fluorescence is now useful for the diagnosis of mucosal lesions.

AIM

The aim of this study was to explore the use of fluorescence technology to identify different types of stoma mucosal lesions, which often appear healthy under standard examination with white light. This study is the first advanced nursing innovation to use fluorescence diagnostics technology for a detailed examination of the stoma mucosa.

METHODS

Patient recruitment was performed by a nurse consultant during the stoma patient follow up visit to the "Wound and Stoma Clinic". The recruited subjects varied from

the early postoperative period to 3 years post-operation. Subjects were recruited for fluorescence examination if they complained of stoma bleeding. The stoma mucosa was examined with a simple light source (standard stoma nursing assessment). For the fluorescence examination, a fluorescent strip was completely immersed in 10ml of 0.9% normal saline. The stained saline was applied to the stoma mucosa. The stoma was visualised using a microscope with a 10X objective and blue light in the dark. The principle of fluorescence diagnostics is based on scanning and analysing the reflected light from the mucosa. Thus, under blue light, a red-green image of the stained stoma is created. Healthy stoma mucosa appears as a smooth, moist, evenly reflective layer with no staining. On the other hand, an unhealthy or injured stoma appears rugged, dry, leathery and stained under fluorescence.

RESULTS

From June 2014 till May 2015, we examined 127 patients with stoma (either colostomy or ileostomy) in our wound clinic. Interestingly, we noted several clinical findings that were not easily diagnosed without fluorescent examination of the stoma, but appeared clearly under fluorescence. We identified different types of target diagnoses (Fig. 1a – 1d)

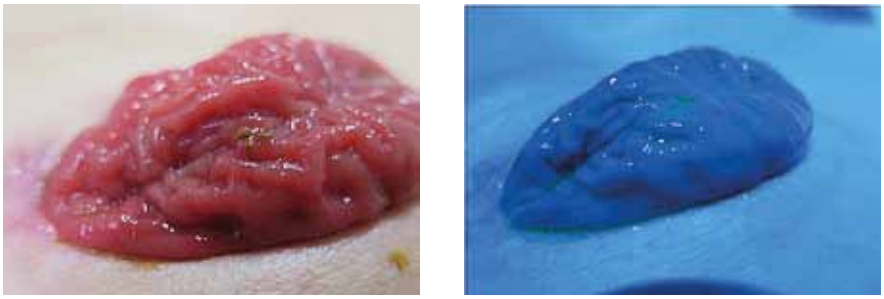

Figure 1a. The stoma appears as normal mucosa, with a smooth and evenly reflective surface under fluorescence.

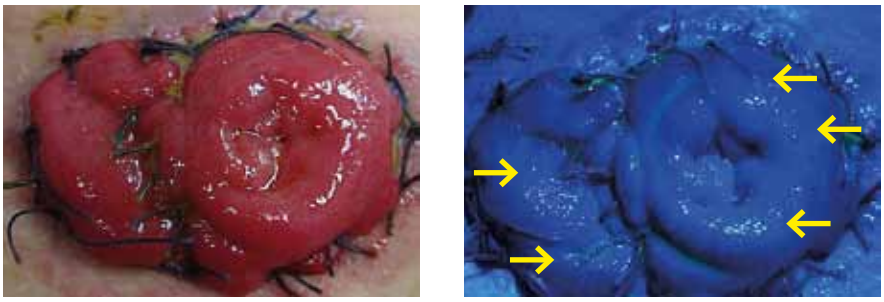

Figure 1b. Fluorescence detects a diffuse fibrous/inflammatory mucosal surface identified as mucositis.

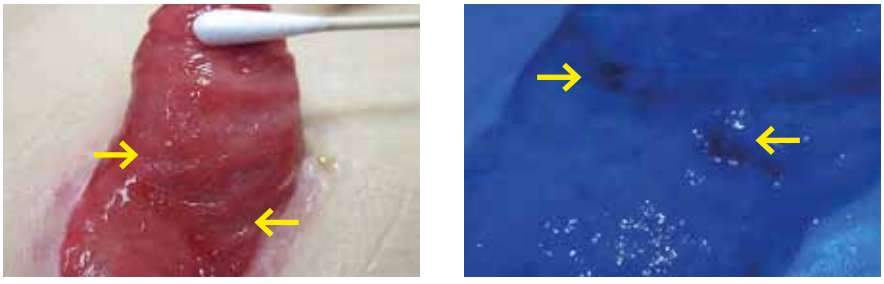

Figure 1c. The fluorescence demonstrates a linear tear corresponding to the site of bleeding.

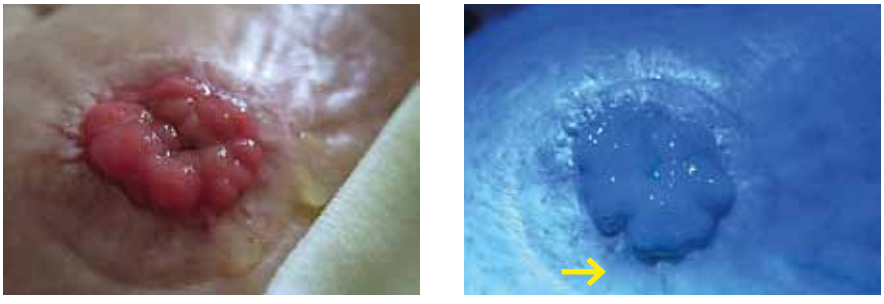

Figure 1d. The fluorescence clearly demonstrates a patchy mucosal abrasion at the stoma base.

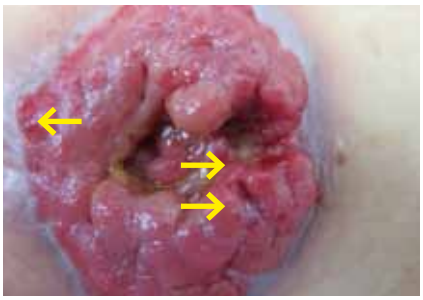

Figure 2. The stoma appears hypertrophic with several bleeders.

Figure 3. The "Plaque Layer" is firstly coated by a topical application of stoma powder.

Figure 4. The "Sealant Plaque" is well formed by the stoma protective spray of the coated layer.

Figure 5. The stoma mucosa is plicated with 3/O Nylon stitches to stop bleeding from the ulcer.

despite the appearance of viable red stoma. In total, we examined 127 stomata using fluorescence, with 153 diagnoses including mucositis (47%), local ulceration (7%), laceration (3%), local bleeder (14%), mucosal tear (13%), and nothing abnormal (16%).

PERSPECTIVES FOR WOUND CARE

Wound management of stomal mucositis is focused on the control of bleeding and the treatment of local inflammation. Bleeding often occurs in different areas from the stoma mucosa. Thus, a sealant plaque is applied to protect the whole stoma mucosa. The sealant plaque is formed by a "stoma powder" containing pectin and karaya (Fig. 2-3), coupled with a stoma skin protective spray (Fig. 4). The sealant plaque minimises and stops bleeding from dilated capillaries in the mucosa. Haemostatic outcomes may be markedly and gradually improved by the sealant in a week, as the sealant layers become more firm and thickly coat the stoma mucosa. The challenge is to encourage patience and provide detailed patient education, including an instruction sheet. Patients may return early for plication of stitches (Fig. 5) or local treatment with an adrenaline and silver nitrate stick if the stoma bleeding cannot be easily controlled. Alternatively, for patients who are diagnosed with stoma ulceration or laceration, hydrogel may be applied to the affected lesions after stoma cleansing.

DISCUSSION

Like any other assessment tool, there are limitations to fluorescence diagnosis of stoma mucosa. The main concern is vascular integrity, which may not be clearly detected, leading to a misdiagnosis under fluorescence. Vascular compromise of intestinal stomata ranges from mild ischaemia and vasospasm with mucosal sloughing, to infarction and necrosis. Additionally, venous outflow obstruction may lead to significant venous congestion and compromised bowel perfusion, which may also cause necrosis of the stoma. Vascular compromise represents the most serious early complication of stoma creation.[7] Failure to trans-illuminate the nonviable mucosa beneath the stoma surface may lead to stoma revision. Vascular compromise below the fascia can also be evaluated with a paediatric proctoscope or flexible endoscope.[7]

Although fluorescence is a highly sensitive diagnostic tool to identify different mucosal aetiologies in a clinical setting, the limitation is low validity among different stoma nurse practitioners in different centres. The validity may be improved if fluorescence diagnostic tools can be standardised in nursing protocols and included in clinical training. In addition, the lighting hue and the low frequency of the blue light, plus the low power of the hand-held microscope may affect diagnostic accuracy. The technology of fluorescence diagnostic tools, as well as nursing protocols for examining stoma, may advance in the near future.

CONCLUSION

Stoma mucosal lesions are often inevitable. Careful consideration of patients' complaints and a detailed examination of the stoma are of the utmost importance in stoma nurs-

ing care. Although a stoma may appear healthy under the naked eye, minor stoma complications may exist. Fluorescence diagnostics is a user-friendly, non-invasive, and sensitive diagnostic tool for examining stoma mucosal lesions and underlying structures in a more detailed manner (Fig. 6). Promotion of the advantages of this diagnostic method is necessary, and fluorescent technologies warrant further assessment among clinicians. Based on the fluorescence diagnostics technique, we are going to explore algorithms for diagnosis and treatment of "invisible" stoma mucosal lesions and advanced wound assessment in the near future.

Acknowledgements: We would like to acknowledge Ada, Chan Wai Yan, who played a critical role in the discovery of this nursing innovation of using fluorescence in stoma diagnosis. We give our unspoken thanks to Dr. Tang Chung Ngai and Dr. Hester Cheung for clinical guidance and supervision, and Mr. Lawrence Poon for administrative support in nursing innovation. This clinical innovation could not be achieved without their hospital management and clinical support..

Fig 6. Stoma examination using the Fluorescence Diagnostics in the Wound and Stoma Clinic.

REFERENCES

1. Siero A, Siero-Stołtny K, Kawczyk-Krupka A, Latos W, Kwiatek S, Straszak D, Bugaj AM. The role of fluorescence diagnosis in clinical practice. Onco Targets Ther. 2013; 6:977-82.
2. Kalashnikovs I, Achkasov S, Fadeeva S, Vorobiev G. The development and use of algorithms for diagnosing and choosing treatment of ostomy complications: results of a prospective evaluation. Ostomy Wound Management. 2011 Jan; 20-27.
3. Buckle N. The dilemma of choice: introduction to a stoma assessment tool. Gastrointestinal Nursing. 2013; 11(4):26-32.
4. Cancer related mucositis management. Gippsland Oncology Nurses Group Cancer Care Guidelines. 2007; Jun:1-4.
5. Mount Laurel NJ. Stoma complications: Best practice for clinicians. Wound, Ostomy and Continence Nurses Society. 2014:2-25.
6. Prevention and treatment of oral mucositis in cancer patients. Best Practice: Evidence Based Practice Information. Sheets for Health Professionals. 1998; 2(3):1-6.
7. Kann BR. Early Stomal Complications. Clinics in Colon and Rectal Surgery. 2008; 21(1):23-30.
8. Hegyi J, Hegyi V, Ruzicka T, Arenberger P, Berking C. New developments in fluorescence diagnostics. JDDG. 2011; 9:368–72.