Case Report **Open Access**

Maria Alessandra Bocchiotti, Luca Raimondo, Silvia Germano, Erind Ruka*, Ambra Frenello, Massimiliano Garzaro and Giancarlo Pecorari

Use of the sternocleidomastoid flap in association with a dermal regeneration template and a skin graft in the temporal region reconstruction

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Abstract: Since its first description in 1908, the sternocleidomastoid flap (SCM) has gained popularity in head-and-neck reconstruction as a regional flap. We reported a 69-year-old Caucasian male who was evaluated in our clinic for a large, bloody, esophitic, and ulcerated lesion of the right temporoparotideal region associated with several actinic keratoses of the head skin. After resection of the tumor, taking into consideration the patient's comorbidities and surgical defect characteristics, we decided to use the SCM flap for the reconstruction. The SCM flap was harvested as a muscular flap to avoid as possible skin paddle necrosis due to the poor conditions of the patient's vessels. Moreover, considering the surgical site depth and to prevent a postsurgical excessive scar retraction, the muscle was covered with Integra® Dermal Regeneration Template single layer and a skin graft was harvested from the left thigh. The follow-up at 1 year confirmed that both oncological and reconstructive goals were successfully achieved. In our experience, the SCM flap in association with a dermal regeneration template and a skin graft can be considered as a reliable and possible option in temporal region reconstruction when local or systemic conditions of the patient do not permit other reconstructive options.

Keywords: basocellular carcinoma; head-and-neck reconstruction; sternocleidomastoid flap; temporal region.

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Introduction

The sternocleidomastoid (SCM) flap is used in a large variety of applications, such as face reanimation, prevention of Frey's syndrome, reconstruction of the cheek, reconstruction of the floor of the mouth, reconstruction of the lower jaw, reconstruction of the oropharyngeal and hypopharyngeal wall, and reconstruction of the laryngotracheal complex in both adults and children. It is also very useful in closing the pharyngocutaneous and cervicoesophageal fistulas and protecting the carotid and anonymous arteries [1, 2].

This flap can be also used for the coverage of the anterior and posterior neck, the lower and midlateral face, the oral cavity, and the occipital scalp or for the reconstruction of the mandible and facial reanimation [3, 4].

After wide and composite resections of the temporal region, several reconstructive options can be chosen: direct closure, skin grafts, dermal regeneration templates, local flaps, regional flaps, and free flaps. The best option has to be identified after a careful analysis of the surgical defect and the patient's morbidities. In this case report, we present the reconstruction of this region using the SCM flap in association with a dermal regeneration template and a skin graft after resection of a large basal cell carcinoma.

Case report

A 69-year-old Caucasian male was evaluated in our clinic for a large, bloody, esophitic, and ulcerated lesion of the right temporoparotideal region associated with several actinic keratoses of the head skin (Figure 1A). A complete peripheral paralysis of the right facial nerve was observed.

Accurate medical history showed familiar ischemic cardiopathy, arterial hypertension, and type 1 diabetes. The patient was a heavy smoker (40 cigarettes/day) and

Figure 1: A 69-year-old patient presenting a basocellular carcinoma of the preauricular region.
Preoperative view (A), skin graft after 5 days (B), and reconstructive and aesthetic outcome after 1 year (C).

a moderate wine drinker. He was a retired mason. The remote pathological history showed in 2007 a surgical excision of a basocellular skin carcinoma of the frontal region and in 2010 a second surgical intervention for another basocellular skin carcinoma of the right preauricular region. After 1 year, a new lesion in the preauricular region was detected and investigated with a punch biopsy; the histological examination revealed a relapse of the basocellular carcinoma. The patient did not accept the recommended surgical procedure, and after 14 months, he came to our attention with the above-described clinical situation. A computed tomography (CT) scan was required and it showed a cutaneous lesion of 6×4 cm of the temporoparotideal right region infiltrating the anterior part of the right auricle, the skin, the subcutaneous tissues, the parotid gland, the temporal muscle, and the zygomatic arch. No signs of infiltration of the temporomandibular joint and the temporal bone were observed.

The patient was collegially evaluated by ENT and plastic surgeons and was therefore prepared for surgery.

After skin marking, a circular incision at 1.5 cm from tumor border, including the anterior part of the auricle, was performed (Figure 2A). A full-thickness excision, associated with superficial parotidectomy with facial nerve sacrifice, was carried out to split the infiltrated tissues from the healthy tissues underlying the temporal bone and adjacent structures. The CT finding of zygomatic arch infiltration was macroscopically confirmed and its partial excision was required; the temporomandibular joint was completely preserved.

At the end of the ablative step, there was a circular loss of substance of 10 cm in diameter and 3.5 cm in depth, composed of periosteum, deep temporal fascia, temporalis muscle, superficial temporal fascia, subcutis, and skin (Figure 2B). The intraoperative histology was used and it was negative without infiltration of the defect margins.

Surgical incision was then extended to the neck following the anterior margin of the SCM muscle; subcutaneous tissues and platisma muscle were incised. The dissection was continued by splitting the superficial cervical fascia and by sacrificing the transverse cervical nerve and the great auricular nerve to expose entirely the SCM muscle. Afterward, its sternal and clavicular origins were discontinued and the deep layer of the superficial cervical fascia was split from the muscle. The minor pedicles were ligated and the dissection was continued cranially up to the pivot point located 1.5 cm below the entry point of the dominant pedicle in the SCM muscle. During flap elevation, careful attention was paid to identify the spinal accessory nerve: it was split from the SCM muscle to preserve the correct shoulder functionality and to guarantee the widest arch of rotation (Figure 2C).

After elevation, the muscular flap was rotated 180° cranially and its free part was fanned out and sutured circumferentially to the residual deep temporal fascia to cover the deperiosted temporal bone (Figure 2D). The muscular tissue was then covered with Integra® Dermal Regeneration Template single layer (Integra LifeSciences, Inc., Plainsboro, NY, USA; Figure 2E) and a thin dermal-epidermal graft was harvested from the right thigh (Figure 2F). A drainage tube was placed in the cervical space and removed after 4 days. The graft was covered with a wet moulage and the dressing was changed after 5 days: the percentage of engraftment was near 100% (Figure 1B). The patient was discharged after 10 days and was evaluated postoperatively after 15, 30, 90, 180, and 360 days (Figure 1C). Definitive histological examination performed on surgical specimen demonstrated a radical exeresis of the basocellular carcinoma. Oncological follow-up was scheduled every 3 months.

Discussion

The SCM muscle flap is well described in head-and-neck reconstruction and can be used as a muscular,

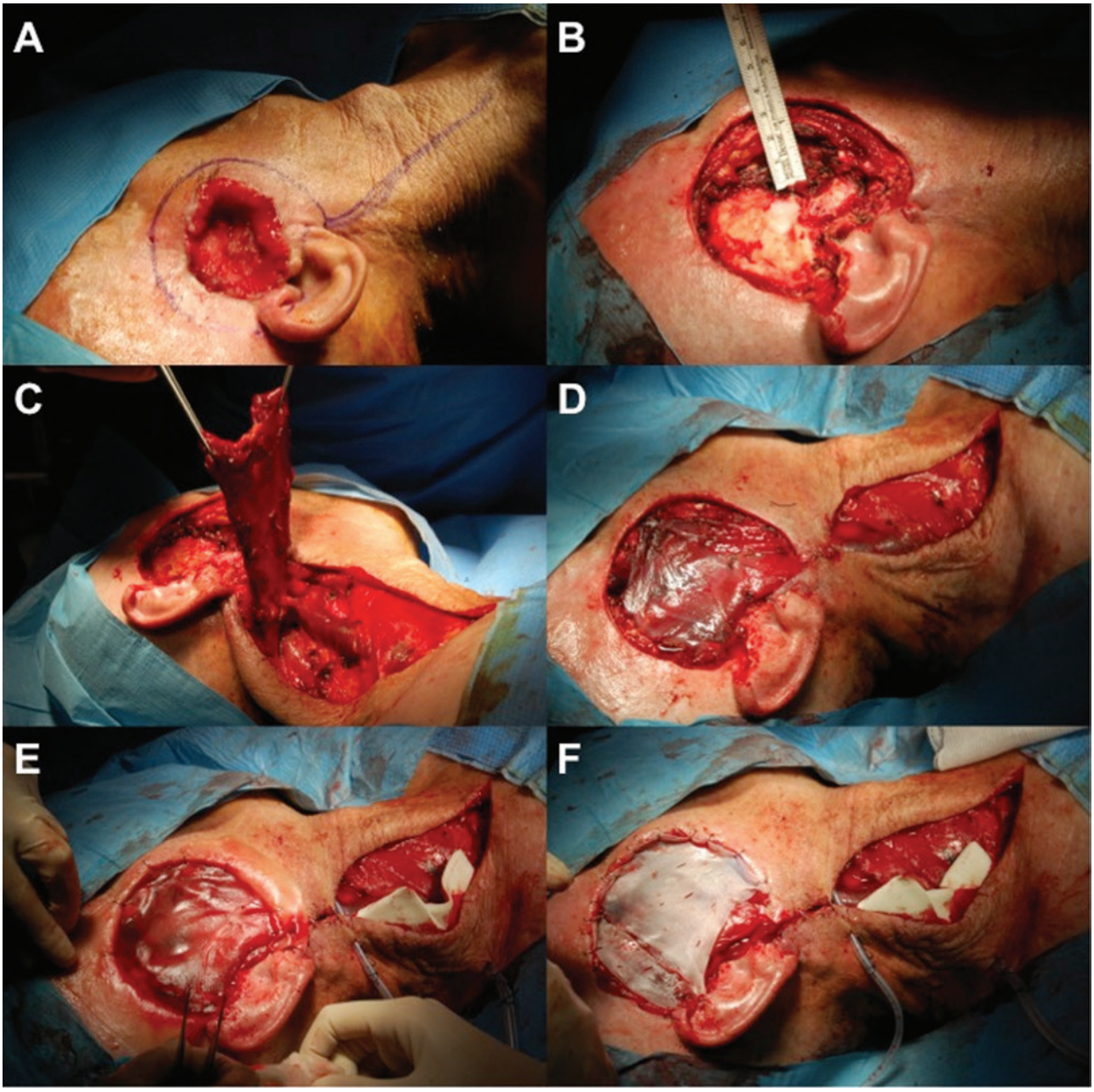

Figure 2: Preoperative view (A), surgical defects (B), SCM flap elevated (C), SCM muscle fanned out and sutured to surgical defect margins (D), Integra® Dermal Regeneration Template single layer covering SCM muscle (E), and skin graft covering Integra® (F).

myocutaneous, and myosseous flap. From the literature analysis, the SCM flap presents a few limits: Larson and Goepfert [5] questioned its reliability and the limited arc of rotation due to the presence of the accessory nerve. Alvarez et al. [6] focused their attention on the neck deformity after the transposition of the whole SCM muscle; no functional alterations of the head rotation were reported.

A debate is still open about its oncological safety. Its use after ablative surgery, performed for malignant tumors, is documented in the literature [2]. However, the authors did not demonstrate its safe use in patients with a N+ neck [2]. Therefore, SCM flap use in a metastatic neck must be carefully meditated; in our opinion, considering the published data, an evidence of positive cervical nodes could be considered as an absolute contraindication.

The SCM flap, in addition to recipient and donor site general complications, has an unreliable skin paddle: in more than 50% of the cases, a complete skin loss is observed. Such event is justified by the tenuous blood supply of the skin isle due to the platysma presence: it is

theoretically unlikely that the SCM perforators would be the major blood supply to this skin [5].

In this case report, the challenge was represented by the reconstruction of the loss of substance resulting after the exeresis of an $rT_3N_0M_0$ (stage III) basocellular carcinoma of the right temporoparotideal region in a multiproblematic patient.

Patient's comorbidities and surgical defect characteristics made the reconstruction with SCM flap the only available option, as the others were impracticable or unsafe, exposing the patient to a possible reintervention in case of failure. In particular, data obtained from medical history and color Doppler ultrasonography showed a seriously compromised macrovascular and microvascular pattern: a strict contraindication to local and distant flap use. Moreover, the depth of surgical defect and its floor composed of the deperiosted temporal bone did not allow the use of a skin graft alone or of Integra® Dermal Regeneration Template with skin graft. Therefore, regional flaps were the only feasible way to achieve an efficient reconstruction in our patient. Possible options were the trapezius flap and the supraclavicular artery island flap. However, they were not considered due to the surgical defect dimensions and the length of the surgery in our hands. During the preoperatory workup, an angio-CT focused on neck and shoulder vessels was performed with the aim to assess the patency of the right transverse cervical artery (TCA): images obtained showed an obstruction of more than 50% of the lumen of the right TCA compared to the contralateral one. Such findings oriented our decision toward the SCM flap use. We chose the form without the skin paddle, considering the poor conditions of the patient's vessels. Considering surgical site depth, and to avoid a postsurgical excessive scar retraction, the muscle was covered with Integra® Dermal Regeneration Template single layer and a skin graft was harvested from the left thigh. As stated in the literature, dermal regeneration templates can be successfully used over flap muscles and in combination with skin grafts [7–9]. We do think that, in these patients presenting high comorbidities, this two-step technique was perfectly adapted. Combining the old technique of the flap with the approach of using an Integra® template together with a skin graft allowed us to obtain a satisfactory reconstruction, to keep operation time and burden as low as possible, and to avoid further complications for this patient.

In our patient, both ablative and reconstructive steps were successful: oncological radicality was achieved as demonstrated by free margins described by the pathologist on surgical specimen, and reconstructive and aesthetic outcome, evaluated after 1 year, was acceptable as shown in Figure 2 (Figure 1C). Functional restrictions due to nerve injury were limited.

Probably, a better final aesthetic outcome could have been achieved if different reconstructive options would have been used; however, the patient's comorbidities forced us to choose this flap.

Conclusion

In our experience, the SCM flap in association with a dermal regeneration template and a skin graft can be considered as a reliable and possible option in temporal region reconstruction when local or systemic conditions of the patient do not permit other reconstructive options.

Author Statement

Research funding: Authors state no funding involved. Conflict of interest: Authors state no conflict of interest. Financial disclosure: None of the authors has a financial interest in any of the products, devices, or drugs mentioned in this manuscript. Informed consent: Patient provided written consent prior to his inclusion in the study. Ethical approval: The study was approved by the Ethics Committee of our institution and was performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki and its later amendments.

Author Contributions

Maria Alessandra Bocchiotti: Design of the study. Luca Raimondo: Data retrieval. Silvia Germano: Analysis of literature. Erind Ruka: Approval of the manuscript. Giancarlo Pecorari: Design of the study. Ambra Frenello: Analysis of literature. Massimiliano Garzaro: Data retrieval.

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Supplemental Material: The article (DOI: 10.1515/iss-2016-0030) offers reviewer assessments as supplementary material.

Reviewer Assessment **Open Access**

Maria Alessandra Bocchiotti, Luca Raimondo, Silvia Germano, Erind Ruka*, Ambra Frenello, Massimiliano Garzaro and Giancarlo Pecorari

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Reviewers' Comments to Original Submission

Reviewer 1: Luc Téot

Nov 27, 2016

Reviewer Recommendation Term:	Revise with Major Modifications
Overall Reviewer Manuscript Rating:	53

Custom Review Questions	**Response**
Is the subject area appropriate for you?	5 - High/Yes
Does the title clearly reflect the paper's content?	4
Does the abstract clearly reflect the paper's content?	3
Do the keywords clearly reflect the paper's content?	3
Does the introduction present the problem clearly?	2
Are the results/conclusions justified?	2
How comprehensive and up-to-date is the subject matter presented?	3
How adequate is the data presentation?	2
Are units and terminology used correctly?	4
Is the number of cases adequate?	1 - Low/No
Are the experimental methods/clinical studies adequate?	3
Is the length appropriate in relation to the content?	3
Does the reader get new insights from the article?	3
Please rate the practical significance.	4
Please rate the accuracy of methods.	4
Please rate the statistical evaluation and quality control.	N/A
Please rate the appropriateness of the figures and tables.	2
Please rate the appropriateness of the references.	2
Please evaluate the writing style and use of language.	2
Please judge the overall scientific quality of the manuscript.	2
Are you willing to review the revision of this manuscript?	Yes

Comments to Authors:
Congratulations to the authors for a well done case. However the discussion should be adapted to the problem: instead of justifyibg the choice of not harvesting the skin together with the muscle SCM flap would be more interesting to promote the use of Integra in such situations and this part is missing.
The authors should report the literature about using a dermal substitute over a muscle flap and add this paragraph to the text. This two step technique is perfectly adapted to patients presenting high comorbidities

Reviewer 2: Jörn Kuhbier

Dec 16, 2016

Reviewer Recommendation Term:	Revise with Major Modifications
Overall Reviewer Manuscript Rating:	72

Custom Review Questions	**Response**
Is the subject area appropriate for you?	5 - High/Yes
Does the title clearly reflect the paper's content?	5 - High/Yes
Does the abstract clearly reflect the paper's content?	4
Do the keywords clearly reflect the paper's content?	4
Does the introduction present the problem clearly?	4
Are the results/conclusions justified?	4
How comprehensive and up-to-date is the subject matter presented?	3
How adequate is the data presentation?	3
Are units and terminology used correctly?	4
Is the number of cases adequate?	2
Are the experimental methods/clinical studies adequate?	3
Is the length appropriate in relation to the content?	4
Does the reader get new insights from the article?	2
Please rate the practical significance.	4
Please rate the accuracy of methods.	4
Please rate the statistical evaluation and quality control.	1 - Low/No
Please rate the appropriateness of the figures and tables.	4
Please rate the appropriateness of the references.	3
Please evaluate the writing style and use of language.	3
Please judge the overall scientific quality of the manuscript.	4
Are you willing to review the revision of this manuscript?	Yes

Comments to Authors:
Dear authors,
the article „USE OF THE STERNOCLEIDOMASTOID FLAP IN ASSOCIATION WITH A DERMAL REGENERATION TEMPLATE AND A SKIN GRAFT IN THE TEMPORAL REGION RECONSTRUCTION“ is about the utilization of the sternocleidomastoid flap in a skin and soft tissue defect reaching the corticalis of the temporalis bone. The defect was caused by exision of a basocellular carcinoma. The flap was used because the patient was multimorbid to keep operation time and burden as low as possible. No skin island was used due to unreliability of the skin perforators and poor vascular status of the patients, additionally, a Integra Dermal Regeneration template and a skin graft from the thigh were used to cover the sternocleidomastoid muscle flap.
Overall, the case report does not report a new technique, however, the idea to use an „old“ technique for multimorbid patients together with new strategies like the Integra template is tempting.
Nevertheless, I think the manuscript needs some revision. First, I would check the language once more. It is not bad at all, but I think sometimes the wording might be checked. Instead of putting the focus on the „old concept used today“ I would stress out more the novelty of combing the old technique of the flap together with the approach of using an Integra template together with a skin graft. The question whether intraoperative histology is used concerning the infiltration of the defect margins is not answered in the manuscript. The question if and in which extent the patient suffered functional restrictions due to nerve damaged caused in the operation, should be answered.
Additionally, references for alternative operative procedures that could not be carried out due to time duration should be given as well as references for the idea to use a dermal template together with a skin graft (like Heckmann A, Radtke C, Rennekampff HO, Jokuszies A, Weyand B, Vogt PM. [One-stage defect closure of deperiosted bone and exposed tendons with MATRIDERM® and skin transplantation. Possibilities and limitations]. Unfallchirurg. 2012; 115(12):1092-8.).
With these revisions, I think the Case Report will be suitable for publication in „Innovative Surgical Sciences“.

Authors' Response to Reviewer Comments

Dec 26, 2016

Reviewer #1: Congratulations to the authors for a well done case.
However the discussion should be adapted to the problem: instead of justifyibg the choice of not harvesting the skin together with the muscle SCM flap would be more interesting to promote the use of Integra in such situations and this part is missing.
The authors should report the literature about using a dermal substitute over a muscle flap and add this paragraph to the text. This two step technique is perfectly adapted to patients presenting high comorbidities
- We would like to thank the reviewer for his comments. We do agree that is more interesting to promote the use of Integra. The discussion part was extended. We added the references related to the use of the dermal substitute over a muscle flap.

Reviewer #2: Dear authors,

the article "USE OF THE STERNOCLEIDOMASTOID FLAP IN ASSOCIATION WITH A DERMAL REGENERATION TEMPLATE AND A SKIN GRAFT IN THE TEMPORAL REGION RECONSTRUCTION" is about the utilization of the sternocleidomastoid flap in a skin and soft tissue defect reaching the corticalis of the temporalis bone. The defect was caused by exision of a basocellular carcinoma. The flap was used because the patient was multimorbid to keep operation time and burden as low as possible. No skin island was used due to unreliability of the skin perforators and poor vascular status of the patients, additionally, a Integra Dermal Regeneration template and a skin graft from the thigh were used to cover the sternocleidomastoid muscle flap.
Overall, the case report does not report a new technique, however, the idea to use an "old" technique for multimorbid patients together with new strategies like the Integra template is tempting.
- We would like to thank the author for his comments. These comments can improve the quality of our work.

Nevertheless, I think the manuscript needs some revision. First, I would check the language once more. It is not bad at all, but I think sometimes the wording might be checked.
- We checked once more the wording.

Instead of putting the focus on the "old concept used today" I would stress out more the novelty of combing the old technique of the flap together with the approach of using an Integra template together with a skin graft.
- The discussion was extended and this point was stressed.

The question whether intraoperative histology is used concerning the infiltration of the defect margins is not answered in the manuscript.
- The intraoperative histology was used and it was negative without infiltration of the defect margins. We added this part in the text.

The question if and in which extent the patient suffered functional restrictions due to nerve damaged caused in the operation, should be answered.
- Functional restrictions due to nerve injury were limited. We added this part in the text.

Additionally, references for alternative operative procedures that could not be carried out due to time duration should be given as well as references for the idea to use a dermal template together with a skin graft (like Heckmann A, Radtke C, Rennekampff HO, Jokuszies A, Weyand B, Vogt PM. [One-stage defect closure of deperiosted bone and exposed tendons with MATRIDERM® and skin transplantation. Possibilities and limitations]. Unfallchirurg. 2012; 115(12):1092-8.).
- References were added.

With these revisions, I think the Case Report will be suitable for publication in "Innovative Surgical Sciences".

Reviewers' Comments to Revision

Reviewer 1: Luc Téot

Jan 10, 2017

Reviewer Recommendation Term:	Accept
Overall Reviewer Manuscript Rating:	75

Custom Review Questions	**Response**
Is the subject area appropriate for you?	5 - High/Yes
Does the title clearly reflect the paper's content?	5 - High/Yes
Does the abstract clearly reflect the paper's content?	4
Do the keywords clearly reflect the paper's content?	4
Does the introduction present the problem clearly?	4
Are the results/conclusions justified?	4
How comprehensive and up-to-date is the subject matter presented?	4
How adequate is the data presentation?	3
Are units and terminology used correctly?	4
Is the number of cases adequate?	2
Are the experimental methods/clinical studies adequate?	3
Is the length appropriate in relation to the content?	4
Does the reader get new insights from the article?	4
Please rate the practical significance.	3
Please rate the accuracy of methods.	3
Please rate the statistical evaluation and quality control.	N/A
Please rate the appropriateness of the figures and tables.	3
Please rate the appropriateness of the references.	4
Please evaluate the writing style and use of language.	3
Please judge the overall scientific quality of the manuscript.	3
Are you willing to review the revision of this manuscript?	Yes

Comments to Authors:
Much better version
this article may be published

Reviewer 2: Jörn Kuhbier

Jan 03, 2017

Reviewer Recommendation Term:	Accept
Overall Reviewer Manuscript Rating:	90

Custom Review Questions	**Response**
Is the subject area appropriate for you?	5 - High/Yes
Does the title clearly reflect the paper's content?	5 - High/Yes
Does the abstract clearly reflect the paper's content?	5 - High/Yes
Do the keywords clearly reflect the paper's content?	5 - High/Yes
Does the introduction present the problem clearly?	4
Are the results/conclusions justified?	5 - High/Yes
How comprehensive and up-to-date is the subject matter presented?	4

How adequate is the data presentation?	5 - High/Yes
Are units and terminology used correctly?	5 - High/Yes
Is the number of cases adequate?	N/A
Are the experimental methods/clinical studies adequate?	5 - High/Yes
Is the length appropriate in relation to the content?	5 - High/Yes
Does the reader get new insights from the article?	4
Please rate the practical significance.	4
Please rate the accuracy of methods.	5 - High/Yes
Please rate the statistical evaluation and quality control.	N/A
Please rate the appropriateness of the figures and tables.	5 - High/Yes
Please rate the appropriateness of the references.	5 - High/Yes
Please evaluate the writing style and use of language.	5 - High/Yes
Please judge the overall scientific quality of the manuscript.	4
Are you willing to review the revision of this manuscript?	Yes

Comments to Authors:
Dear authors,

congratulations to your splendid case report.
With the changes implemented, the manuscript is now suitable for publication in Innovative Surgical Sciences.

There is just the last reference number 9 in the reference section to be checked, because there are the numbers of the authors affliations as used in PubMed still after the names.