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*This Issue of the AHNS Journal Club has been compiled and reviewed by members of the **AHNS Head & Neck Reconstructive Committee:***

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Accuracy of computer-assisted mandibular reconstructions using patient-specific implants in combination with CAD/CAM fabricated transfer keys.

Mascha F, Winter K, Pietzka S, Heufelder M, Schramm A, Wilde F.

From **Journal of Cranio-Maxillo-Facial Surgery**, *September, 2017*

BACKGROUND: A new method in mandible reconstruction has recently been developed using patient-specific mandible reconstruction plates (PSMP) after preoperative computer planning using CAD/CAM procedures. To transfer the virtual planned position of the PSMP into the intraoperative situs resection margins and plate position is determined by using surgical guides made by CAD/CAM procedures as well (PSMP-method).

METHODS: Mandibular reconstruction with the PSMP-method was performed on 18 patients. The study included sole alloplastic reconstruction cases (AP, n = 10) and microvascular osseous reconstruction cases (MV, n = 8). Pre- and postoperative CT-scans were evaluated by measuring distances between corresponding landmarks on the mandibular rami. The difference was used to evaluate reconstruction accuracy.

RESULTS: The median deviation of all distances was 1.13 mm for PSMP-method including all cases. For AP-group, the median deviation was 0,80 mm, for MV-group it was 2,47 mm. There was a high significant difference between both groups (AP and MV). Larger mandibular resections in combination with the need of positioning the surgical guides in the region of the upper condyle seemed to reduce reconstruction-accuracy. This was found more often in MV-group as in the AP-group.

CONCLUSIONS: PSMP-method seems to be an effective and satisfying method for accurate mandibular reconstruction. Microvascular reconstruction seems less accurate than sole alloplastic reconstruction. Larger resections of the mandible and technical more challenging approaches up to the mandibular condyle might explain this result.

Summary statements:

- Advantage of patient-specific mandibular plate (PSMP) reconstruction allows correct anatomical position of the reconstructed mandible, as well as, improved positioning of dental prosthesis
- Study aims as an endpoint deviation of inter-rami and inter-condyle distances to assess efficacy of PSMP
- Larger resections and involvement of the condyle result in less precise reconstructions

Strengths

- Demonstrates accuracy of computer guided reconstruction for both alloplastic and microvascular bone transfers
- Uses multiple point-specific inter-mandibular measurements in order to assess accuracy of reconstruction
- Establishes the importance of using CAD/CAM reconstruction for large mandibular resections

Weaknesses

- Small series of patients
- Single center study

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Free Flap Reconstruction Monitoring Techniques and Frequency in the Era of Restricted Resident Work Hours.

Patel UA, Hernandez D, Shnayder Y, Wax MK, Hanasono MM, Hornig J, Ghanem TA, Old M, Jackson RS, Ledgerwood LG, Pipkorn P, Lin L, Ong A, Greene JB, Bekeny J, Yiu Y, Noureldine S, Li DX, Fontanarosa J, Greenbaum E, Richmon JD.

From **JAMA Otolaryngology – Head Neck Surgery**, *August 2017*

IMPORTANCE: Free flap reconstruction of the head and neck is routinely performed with success rates around 94% to 99% at most institutions. Despite experience and meticulous technique, there is a small but recognized risk of partial or total flap loss in the postoperative setting. Historically, most microvascular surgeons involve resident house staff in flap monitoring protocols, and programs relied heavily on in-house resident physicians to assure timely intervention for compromised flaps. In 2003, the Accreditation Council for Graduate Medical Education mandated the reduction in the hours a resident could work within a given week. At many institutions this new era of restricted resident duty hours reshaped the protocols used for flap monitoring to adapt to a system with reduced resident labor.

OBJECTIVES: To characterize various techniques and frequencies of free flap monitoring by nurses and resident physicians; and to determine if adapted resident monitoring frequency is associated with flap compromise and outcome.

DESIGN, SETTING, AND PARTICIPANTS: This multi-institutional retrospective review included patients undergoing free flap reconstruction to the head and/or neck between January 2005 and January 2015. Consecutive patients were included from different academic institutions or tertiary referral centers to reflect evolving practices.

MAIN OUTCOMES AND MEASURES: Technique, frequency, and personnel for flap monitoring; flap complications; and flap success.

RESULTS: Overall, 1085 patients (343 women [32%] and 742 men [78%]) from 9 institutions were included. Most patients were placed in the intensive care unit postoperatively (n = 790 [73%]), while the remaining were placed in intermediate care (n = 201 [19%]) or in the surgical ward (n = 94 [7%]). Nurses monitored flaps every hour (q1h) for all patients. Frequency of resident monitoring varied, with 635 patients monitored every 4 hours (q4h), 146 monitored every 8 hours (q8h), and 304 monitored every 12 hours (q12h). Monitoring techniques included physical examination (n = 949 [87%]), handheld external Doppler sonography (n = 739 [68%]), implanted Doppler sonography (n = 333 [31%]), and needle stick (n = 349 [32%]); 105 patients (10%) demonstrated flap compromise, prompting return to the operating room in 96 patients. Of these 96 patients, 46 had complete flap salvage, 22 had partial loss, and 37 had complete loss. The frequency of resident flap checks did not affect the total flap loss rate (q4h, 25 patients [4%]; q8h, 8 patients [6%]; and q12h, 8 patients [3%]). Flap salvage rates for compromised flaps were not statistically different.

CONCLUSIONS AND RELEVANCE: Academic centers rely primarily on q1h flap checks by intensive care unit nurses using physical examination and Doppler sonography. Reduced resident monitoring frequency did not alter flap salvage nor flap outcome. These findings suggest that institutions may successfully monitor free flaps with decreased resident burden.

Summary statements:

- Intensive monitoring of free tissue transfer in the immediate postop phase has been identified as the single most important factor in salvage procedures. Protocols are highly variable among institutions. Changes in resident duty hours mandated by the ACGME altered the paradigm in most institutions. This study examined 1085 patients from 9 academic institutions and evaluated outcomes before and after duty our restrictions.
- There was no statistical difference in flap outcome based on postoperative monitoring venue. There was no association between flap monitoring techniques or number of techniques with flap outcome. Use of medication aimed at reducing flap thrombosis did not have a beneficial association with flap outcome.
- Flap monitoring was by nurses Q1 hourly in over 99% of patients. Resident staff checked the flap Q4 (64%) but also Q 8 (15%) and Q 12 (21%). There was no difference in rates of flap compromise or overall flap outcomes.

Strengths

- Multi-institutional study with significant contributions on an equal basis.
- An externally imposed mandate that was followed by all institutions.
- A large number of patients that were treated in many different ways that allowed for intergroup comparisons.

- This study supports the concept that less intensive medical monitoring while maintaining active nursing monitoring does not alter flap survival rates.

Weaknesses

- Retrospective multi-institutional study with variable numbers of patients submitted prior to duty our changes and after duty our changes.
- Flap monitoring techniques are clustered based on individual practices. An ability to discern the role of the various individual flap monitoring techniques is not possible.
- Even with a number of institutions and high volumes the number of events analyzed is still small. Definitive conclusions based on individual methodologies cannot be drawn.

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Long-term Functional Outcomes of Total Glossectomy With or Without Total Laryngectomy

Lin DT, Yarlagadda BB, Sethi RK, Feng AL, Shnayder Y, Ledgerwood LG, Diaz JA, Sinha P, Hanasono MM, Yu P, Skoracki RJ, Lian TS, Patel UA, Leibowitz J, Purdy N, Starmer H, Richmon JD.

from **JAMA Otolaryngology – Head & Neck Surgery**, *September 2015*

IMPORTANCE: The optimal reconstruction of total glossectomy defects with or without total laryngectomy is controversial. Various pedicled and free tissue flaps have been advocated, but long-term data on functional outcomes are not available to date.

OBJECTIVES: To compare various total glossectomy defect reconstructive techniques used by multiple institutions and to identify factors that may lead to improved long-term speech and swallowing function.

DESIGN, SETTING, AND PARTICIPANTS: A multi-institutional, retrospective review of electronic medical records of patients undergoing total glossectomy at 8 participating institutions between June 1, 2001, and June 30, 2011, who had a minimal survival of 2 years.

INTERVENTION: Total glossectomy with or without total laryngectomy.

MAIN OUTCOMES AND MEASURES: Demographic and surgical factors were compiled and correlated with speech and swallowing outcomes.

RESULTS: At the time of the last follow-up, 45% (25 of 55) of patients did not have a gastrostomy tube, and 76% (42 of 55) retained the ability to verbally communicate. Overall, 75% (41 of 55) of patients were tolerating at least minimal nutritional oral intake. Feeding tube dependence was not associated with laryngeal preservation or the reconstructive techniques used, including flap suspension, flap innervation, or type of flap used. Laryngeal preservation was associated with favorable speech outcomes, such as the retained ability to verbally communicate in 97% of those not undergoing total laryngectomy (35 of 36 patients) vs 44% (7 of 16) in those undergoing total laryngectomy ($P < .001$), as well as those not undergoing total laryngectomy achieving some or all intelligible speech in 85% (29 of 34 patients) compared with 31% (4 of 13) undergoing total laryngectomy achieving the same intelligibility ($P < .001$).

CONCLUSIONS AND RELEVANCE: In patients with total glossectomy, feeding tube dependence was not associated with laryngeal preservation or the reconstructive technique, including flap innervation

and type of flap used. Laryngeal preservation was associated with favorable speech outcomes such as the retained ability to verbally communicate and higher levels of speech intelligibility.

Summary Statements

- This is a multi-institutional retrospective review of speech and swallowing functional outcomes for patients undergoing total glossectomy, with or without a concomitant laryngectomy with appropriate reconstruction.
- In this study, there was no difference in feeding tube dependence based on whether or not a laryngectomy was performed or based on the reconstructive technique used.
- There was significantly better speech function in patients that retained their larynx and in those patients who underwent free flap reconstruction instead of pectoralis major flap repair.

Strengths

- The collection of patients is across multiple centers with expertise and high volume of head and neck surgery producing the largest published series to date looking at functional outcomes for patients following total glossectomy with at least two years of follow up.
- Within the spectrum of head and neck surgical procedures, there is relatively little variation in the ablative portion of the surgery, thus allowing for more controlled analysis of the impact of the reconstructive technique and the presence or absence of a laryngectomy on the functional outcomes being studied.

Weaknesses

- While this is a relatively large number of patients who underwent a total glossectomy as part of their surgery, the overall power of the study is limited as there are multiple potential cofounding variables that may influence the results. Examples include pre-existing swallowing pathology, prior or subsequent radiation, and the technique used for reconstruction.
- The measures used to evaluate speech and swallowing outcomes were not very refined and lacked any true objective assessments or validated tools.
- As is acknowledged by the authors, there is no standardization to determine the type of surgical approach with regards to whether or not to perform a total laryngectomy as part of the operation. As a results, patients with worse pre-operative function may been more likely to have a laryngectomy, resulting in selection bias.

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Intensive care unit versus non-intensive care unit postoperative management of head and neck free flaps: comparative effectiveness and cost comparisons.

Arshad H, Ozer HG, Thatcher A, Old M, Ozer E, Agarwal A, Jafari H, Birkheimer D, Basinger H, Forest LA, Schuller DE, Teknos TN.

From **Head & Neck**, *April 2014*

BACKGROUND: Despite its widespread use, there is no consensus on the postoperative management in patients undergoing free flap reconstructions. We report the largest study comparing flap outcomes, morbidity, and cost in patients with head and neck cancer free flaps who recovered in the intensive care unit (ICU) versus a "specialty floor" setting.

METHODS: This was a retrospective review of patients undergoing free flap surgery for head and neck defects over a 4-year period. Patients before a certain date went to the ICU for immediate postoperative care and after to a non-ICU setting. Postoperative medical and surgical complications and hospital charges were analyzed.

RESULTS: Patients in the ICU group had a longer length of stay (LOS) and incurred greater hospital costs than the patients in the non-ICU setting. There was no difference in the flap failure rate between the 2 groups.

CONCLUSION: Consideration should be given to a floor-based postoperative management regimen for this patient population.

Summary Statements

- There is no widespread consensus on post-operative management of microvascular free flap patients, particularly with respect to intensive care unit (ICU) monitoring or non-ICU settings.
- This study retrospectively reviewed flap patients in a new non-ICU protocoled floor program compared to its previous ICU protocol care (n=138 versus 110 respectively) and evaluated quality and value metrics.
- There was no difference in flap survival or complications between the two groups.
- Length of stay and cost were significantly lower in the non-ICU group. The non-ICU group contributed more revenue to the hospital margin.

Strengths

- This is the first study showing no significant morbidity or mortality with implementation of a non-ICU protocol for head and neck reconstructive patients.
- The single institution setting controls various variables that are present in multi-institutional databases (cost, different payers, different surgeons, geographic/population differences)

Weaknesses

- Smaller N compared to national databases but national database adds many uncontrollable variable and less granular
- Retrospective
- Single institution

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Quality Indicators: Measurement and Predictors in Head and Neck Cancer Free Flap Patients

Antoine Eskander, MD, ScM, FRCS(C), Stephen Y. Kang, MD, Benjamin Tweel, MD, Jigar Sitapara, MD, Matthew Old, MD, Enver Ozer, MD, Amit Agrawal, MD, Ricardo Carrau, MD, James Rocco, MD, PhD, and Theodoros N. Teknos, MD

from **Otolaryngology - Head & Neck Surgery**, *February 2018*

With the potential of bundled payments and "pay for performance" on the horizon, there is a strong need to understand predictors of key quality indicators in head and neck reconstruction. In this study, Eskander et al. report upon 515 patients that underwent head and neck free flap reconstruction and investigate predictors of length of stay (LOS), readmission within 30 days, and unplanned return to OR within 30 days.

The cohort was representative of the HNSCC population; average age was 60 years, 28% had previous radiation and/or chemoradiation, and the majority (75%) were oral cavity cancers. Of the 515 patients included in the study, 31.5% had LOS greater than 9 days, 12.6% were readmitted within 30 days and 14.8% returned to the OR within 30 days.

Significant predictors of LOS greater than 9 days were: length of OR time, blood transfusion, history of diabetes, and tumors involving the following subsites: oral cavity, larynx, and hypopharynx. With regard to OR time, the odds of LOS greater than 9 days increased multiplicatively by 1.25 with each hour increase in OR time. The development of any complication (major or minor) also predicted prolonged hospital stay. Interestingly, one primary predictor of readmission within 30 days was the lack of preoperative assessment clinic consultation prior to surgery. This clinic assesses overall medical fitness and optimizes patients for surgery and general anesthesia. The only significant predictor of unplanned return to OR was age.

Based upon these findings, comprehensive management of diabetes preoperatively, selective use of blood transfusions and OR efficiency/reduction of OR length are of paramount importance for reducing LOS. These data also suggest that routine referral to a preoperative assessment clinic can reduce unexpected readmissions.

Overall, this is the first comprehensive multivariable analysis studying preop, intraop, and postop predictors of LOS, 30 day readmission, and unexpected return to OR in head and neck free flap patients. The authors offer significant and unique findings in a large cohort of patients and offer insight on how these data have changed institutional practice.

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