

## ORIGINAL ARTICLE

# Evaluation of ear, nose, and throat-screening in liver transplantation candidates: A retrospective cohort study

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## Abstract

**Background:** Patients with end-stage liver disease can be treated with a liver transplantation (LT). Before listing, candidates are subjected to a screening procedure according to the EASL Clinical Practice Guidelines for LT. In our hospital, this includes an ear, nose, and throat (ENT) examination, directed towards the identification of (asymptomatic) infections and head and neck malignancies.

**Methods:** We retrospectively reviewed all ENT screening examinations in LT candidates from 2007 to 2022. The screening consisted of a visit to the ENT outpatient clinic combined with sinus radiography.

**Results:** ENT screening was performed in 1099 patients. Sixty-one cases were identified, either diagnosed with an infection ( $n = 58$ , almost exclusively sinusitis) or a neoplasm ( $n = 3$ , of which two malignancies). With binary logistic regression, we could not identify significant risk factors for diagnosing sinusitis. 711 patients underwent LT. After LT, two patients developed a novel malignancy of the head and neck area, while 14 patients were diagnosed with sinusitis, two of the latter already showed opacification on sinus radiography during screening. Despite immunosuppressive drugs, no complicated sinusitis was observed.

**Conclusion:** Sinusitis or a neoplasm was diagnosed in almost 6% in a large cohort of LT candidates. Although almost a third of sinusitis patients were not treated accordingly, we did not observe any complicated sinusitis after LT. A more conservative approach to sinusitis may therefore be justified in LT candidates, especially in asymptomatic cases. At our institution, we aim to refer only those patients with specific ENT complaints.

## KEYWORDS

head and neck neoplasms, listing decision, liver transplantation, screening, sinusitis

**List of Abbreviations:** CI, confidence interval; CT, computed tomography; ENT, ear, nose, and throat; FESS, functional endoscopic sinus surgery; HCC, hepatocellular carcinoma; HNSCC, head and neck squamous cell carcinoma; IQR, interquartile range; LT, liver transplantation; NASH, nonalcoholic steatohepatitis.

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## 1 | INTRODUCTION

In patients with end-stage liver disease, liver transplantation (LT) improves average 10-year survival to >70%.<sup>1</sup> To qualify for LT, candidates undergo thorough screening, part of which is aimed at detecting (latent) infections, premalignant lesions, or neoplasms that either need treatment before transplantation or may even result in a contra-indication of getting listed.<sup>1</sup> Historically, ENT screening has been part of the screening procedure in our hospital and many others, although this is not specifically recommended in the EASL guidelines.

Infections require attention as they may flare up after transplantation when recipients are put on a regimen of immunosuppressive drugs. In the case of otorhinolaryngological involvement, this mainly concerns sinusitis. For patients on immunosuppressive medication, rhinosinusitis can be threatening due to the possibility of the infection spreading to the orbit or intracranial space.<sup>2</sup> Furthermore, invasive fungal sinusitis is a rare but potentially lethal disease that occurs almost exclusively in immunocompromised patients.<sup>3</sup> Therefore, the European guideline recommends treatment of sinus infections prior to LT until clinical and radiological resolution has been obtained.<sup>1</sup>

Screening for neoplastic lesions is performed as a synchronous malignancy is an absolute contra-indication for LT. Alcohol-related liver disease is one of the most common indications for LT<sup>4</sup> and alcohol abuse is also a major risk factor in developing head and neck squamous cell carcinoma (HNSCC).<sup>5</sup> Furthermore, alcohol abuse is often accompanied by smoking<sup>6</sup> and at least 75% of HNSCC are attributable to the combination of alcohol and tobacco consumption.<sup>7</sup> In addition, long-term administration of immunosuppressive agents can increase the risk of developing head and neck cancer after LT.<sup>8,9</sup>

Previous studies on ear, nose, and throat (ENT) screening in liver transplant candidates demonstrated that 0.17%–1.3% of the patients were diagnosed with head and neck cancer,<sup>10,11</sup> while cases of sinusitis were more prevalent, ranging from 2.8 to 11.1%.<sup>12,13</sup> However, none of these studies assessed both infections and neoplasms, and they were hampered by limited sample size. Moreover, the studies predominantly involved slightly older Asian cohorts, while the indication for LT differs between populations and changes over time.<sup>14</sup> Thus, the available estimates may not be representative of our current Western European population.

The primary aim of this study was to evaluate the yield of routine ENT screening in a large and recent cohort of liver transplant candidates in the Netherlands, including cases with infections and neoplasms. The secondary aims were to assess which factors were associated with the presence of ENT abnormalities during screening and to study the occurrence of ENT pathology and related complications after transplantation.

## 2 | METHODS

All consecutive patients, aged 18 and above, who were screened for LT were included in the study, from the start of our electronic patient

registry in February 2007 up to May 2022. Patients were identified from the prospective registry of the LT program of the Erasmus Medical Center. No patients were excluded from these analyses. The study was approved by the Medical Ethics Committee of the Erasmus Medical Center (MEC-2020-0675) and carried out in accordance with both the Declarations of Helsinki and Istanbul. All patients provided written informed consent.

The vast majority of the screening procedures were performed either at the Erasmus Medical Center or the Amsterdam University Medical Center, location AMC. In general, patients were admitted to the ward for screening, and all examinations were ordered and performed within several days. In the Erasmus Medical Center, ENT screening consisted of a visit to the outpatient clinic (including medical history taking, physical examination, and fiber endoscopy when indicated) combined with conventional sinus radiography. Additional radiological evaluation or follow-up visits were planned accordingly. Screening of LT candidates in the Amsterdam University Medical Center was performed by sinus radiology (predominantly computed tomography [CT]), after which an ENT surgeon was only consulted in case of abnormal radiological findings. A small number of patients were screened in other hospitals, where the procedure was similar to the Erasmus Medical Center.

Clinical data was extracted from the electronic patient database (Eline Beukman and Andries Paul Nagtegaal). Excessive alcohol use was defined as >14 units per week for women and >21 units per week for men. The diagnosis of sinusitis was based on a combination of symptoms (**blocked nose**, **rhinorrhea**, reduced smell, and facial pain; two of these—one of the complaints in bold is mandatory—are required for a diagnosis of sinusitis), physical examination (pus, polyps, or edema in the middle meatus), and radiological findings.<sup>15</sup> For the latter, sinusitis was only confirmed in case of severe opacification or an air-fluid level on sinus radiography. Minor mucosal thickening or retention cysts were not considered to be clinically significant and thus discarded as a primary outcome. ENT diagnoses were identified and classified by an experienced otorhinolaryngologist (Andries Paul Nagtegaal).

In addition, all visits to our ENT department after LT were assessed for the occurrence of ENT infections and de novo head and neck neoplasms. These patients were not routinely evaluated, but all were referred due to specific complaints.

The Shapiro-Wilk test was applied to evaluate the distribution of continuous data. Normally distributed data are displayed as a mean with standard deviation, and non-normally distributed data are shown as a median with interquartile range (IQR; 25th and 75th percentiles). Categorical data are presented as numbers with percentages. Binary logistic regression analysis was applied to assess if the following factors were associated with positive ENT findings during screening: sex, age, liver disease, smoking behavior, and a history of excessive alcohol consumption. In order to investigate whether ENT screening results and subsequent treatment had any influence on survival, we evaluated survival distribution between patients with positive versus negative ENT screening by Kaplan-Meier analysis, significance was assessed by a log-rank test. The threshold for statistical significance was set at  $p < .05$ . Data was analyzed using IBM SPSS statistics 25 (IBM Corp.).

**TABLE 1** Basic characteristics, including primary underlying liver disease and listing decision, of all patients that underwent ear, nose, and throat (ENT) screening ( $n = 1099$ ). Numbers refer to individual patients, and percentages relate to the screened population. IQR: interquartile range, 25<sup>th</sup>, and 75<sup>th</sup> percentile; NASH: nonalcoholic steatohepatitis. †Excessive alcohol consumption: >14 glasses per week in women, >21 glasses per week in men.

<b>Age</b>	
Median, years	57 (IQR 47–75)
<b>Sex</b>	
Male	716 (65.2%)
Female	383 (34.8%)
<b>Alcohol consumption history</b>	
Excessive†	293 (26.7%)
<b>Tobacco consumption</b>	
Never	591 (53.8%)
Active	196 (17.8%)
Past	312 (28.4%)
<b>Primary liver disease</b>	
Autoimmune	289 (26.3%)
Alcoholic	240 (21.8%)
Viral	179 (16.3%)
NASH	155 (14.1%)
Cryptogenic/other	236 (21.5%)
<b>Listing decision</b>	
Accepted, total	921 (83.8%)
• Transplanted	• 638 (58.1%)
• Active on list	• 54 (4.9%)
• Deceased on list	• 139 (12.6%)
• Delisted	• 90 (8.2%)
Rejected	164 (14.9%)
Screening discontinued	14 (1.3%)
• On patient initiative	• 8 (0.7%)
• Change in clinical condition	• 6 (0.6%)

### 3 | RESULTS

#### 3.1 | Overview of study group

A total of 1172 patients were evaluated for LT during the study period (2007–2022) and included in this study. In this cohort, 1099 patients (93.8%) underwent ENT screening: 976 (88.8%) at the Erasmus Medical Center, 118 (10.7%) at the Amsterdam University Medical Center, and five (0.5%) were screened elsewhere (Table 1). In 73 patients (6.2%) no ENT screening was performed due to acute liver failure requiring emergency transplantation ( $n = 67$ ) or for reasons unknown ( $n = 6$ ). The local screening protocol was fully adhered to in 1029 patients (93.6%), while in 70 patients (6.4%) screening occurred through either a conventional sinus radiograph or ENT consultation alone, and not by the intended combination of both. Note that, 711 patients underwent LT, of which 638 were screened and 73 were not screened. A schematic overview of patient flow is depicted in Figure 1.

In our cohort, 716 patients (65.2%) were males and the median age at screening was 57 years (IQR 47–75). A history of excessive alcohol

consumption was noted in 293 patients (26.7%). On tobacco consumption, 196 patients (17.8%) were active smokers and 312 patients (28.4%) were former smokers. The primary underlying liver diagnosis was auto-immune liver disease (including autoimmune hepatitis, primary sclerosing cholangitis, and primary biliary cholangitis) in 289 patients (26.3%), alcoholic liver disease in 240 patients (21.8%), viral hepatitis in 179 patients (16.3%), nonalcoholic steatohepatitis in 155 patients (14.1%), and cryptogenic/other diagnoses in 236 patients (21.5%) (Table 1). In 300 patients (27.3%), hepatocellular carcinoma (HCC) was the indication for LT.

A conventional sinus radiograph was performed in 942 patients (85.7%), of which 125 (13.3%) were reported as abnormal, almost half pertaining to non-infectious causes, including retention cysts and hypoplastic sinuses. Sixty-three conventional sinus radiographs (5.7% of the screened population) were compatible with sinusitis, that is, an air-fluid level or complete opacification. A total of 127 patients underwent a CT-sinus (including 20 patients with a follow-up CT after abnormal conventional sinus radiography), of which 22 were diagnosed with sinusitis. There was an overlap between these groups, so taken

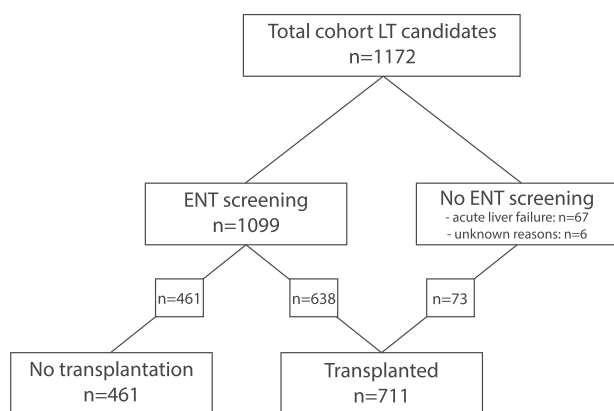


**TABLE 2** Findings of ear, nose, and throat (ENT) screening in 1099 liver transplantation (LT) candidates, which resulted in the identification of  $n = 61$  positive cases (infections and neoplasms). All candidates with an infection were accepted for listing, while adequate sinusitis treatment was lacking in many cases. Neoplasms: sinonasal inverted papilloma (a benign tumor with a small chance of malignant transformation); malignant: supraglottic laryngeal carcinoma (T1N0M0), and squamous cell carcinoma (SCC) of the left neck with unknown primary (TON2bM0). Both head and neck squamous cell carcinoma (HNSCC) patients were rejected for listing. Percentages refer to the total screened population ( $n = 1099$ ). An extended overview can be found in Table S1.

Total ENT screenings	1099
<b>ENT complaints</b>	
None	866 (78.8%)
Sinusitis complaints <sup>a</sup>	49 (4.5%)
Other miscellaneous	184 (16.7%)
<b>X-sinus, total performed</b>	942 (85.7%)
Signs of sinusitis <sup>b</sup>	63 (5.7%)
<b>CT-sinus, total performed</b>	127 (11.6%)
Signs of sinusitis <sup>b</sup>	22 (2.0%)
<b>Total infections</b>	58 (5.3%)
Acute or chronic rhinosinusitis	• 51 (4.6%)
Nasal polyps	• 5 (0.5%)
Fungus ball	• 1 (0.1%)
Cholesteatoma	• 1 (0.1%)
<b>Total neoplasms</b>	3 (0.3%)
Benign	• 1 (0.1%)
Malignant	• 2 (0.2%)

<sup>a</sup>Sinusitis complaints: blocked nose, rhinorrhea, reduced smell, facial pain.

<sup>b</sup>Radiological diagnosis of sinusitis was defined by either severe (full) opacification or an air-fluid level; minor mucosal thickening or retention cysts were discarded.



**FIGURE 1** Schematic overview of the complete study cohort of liver transplantation candidates, consisting of 1172 patients, 1099 of whom underwent ear, nose, and throat (ENT) screening. Seventy-three patients were unscreened, mostly due to time constraints in acute liver failure ( $n = 73$ ) or for reasons unknown ( $n = 6$ ). Out of the cohorts with and without ENT screening, 711 patients received liver transplantation during the study period.

together radiological signs of sinusitis were registered in 55 patients (5.0%) (Table 2). In two patients (0.2%) sinusitis was diagnosed while radiology was normal.

### 3.2 | Outcome of ENT screening in LT candidates

We collected 61 cases with positive screening results (Table 2; in-depth overview in Table S1). There were 57 patients with varying phenotypes of rhinosinusitis, while one patient was diagnosed with a cholesteatoma. Three patients were diagnosed with a neoplasm: a sinonasal inverted papilloma (benign tumor with a small chance of malignant transformation), a supraglottic laryngeal carcinoma (T1N0M0), and a squamous cell carcinoma (SCC) of unknown primary (TON2bM0). A history of excessive alcohol consumption was present in 14 out of 61 cases (23%) and in one out of the two malignancies. Binary logistic regression analysis did not demonstrate any patient characteristics that contributed to the risk of having sinusitis at screening. The model—including age, sex, liver disease, smoking behavior, and a history of excessive alcohol consumption—was only able to explain 3.2% of the variance (Nagelkerke  $R^2$ ).

In the sinusitis patients, only nine out of 57 patients had a history of sinusitis or reported at least two of the four complaints required for confirming the diagnosis.<sup>15</sup> Three patients only had one complaint, while 45 patients (79% of sinusitis cases) were completely asymptomatic. Sinusitis patients were treated as follows: nasal medication (combinations of nasal rinsing, nasal steroids, nasal ointment, xylometazoline; applied in most patients,  $n = 31$ ), oral antibiotics ( $n = 14$ ), functional endoscopic sinus surgery (FESS;  $n = 11$ ), sinus puncture and drainage ( $n = 1$ ). In 19 patients an abnormal conventional sinus

radiograph was not followed up by additional diagnostics (i.e., nasal endoscopy or CT scan) nor was any medical treatment initiated.

### 3.2.1 | Listing decision

After successfully completing the screening procedure, 921 patients (83.8%) were accepted on the waiting list: 638 (58.1%) underwent an LT, 54 (4.9%) are still active on the waiting list, 139 (12.6%) deceased while on the waiting list, and 90 (8.2%) were delisted at a later stage—usually due to a decline in clinical condition or the development of severe comorbidity. 164 patients (14.9%) completed the screening procedure but did not comply with the requirements for listing and were thus not placed on the waiting list. Screening was discontinued in 14 patients (1.3%): in six patients (0.6%) screening was halted due to improving clinical condition ( $n = 3$ ), detection of metastases ( $n = 2$ ) or a concurrent T-cell lymphoma ( $n = 1$ ); another eight patients (0.7%) abandoned the screening procedure on their own initiative. In the group of positive ENT screening results, only the two cases with malignancy were rejected for LT. None of the sinusitis patients were rejected for listing, although 17 patients first required medical or surgical treatment before getting listed (Table S1).

### 3.2.2 | Survival

The median follow-up period of patients with ENT screening was 3.1 years (IQR 0.9–6.6). Overall, the cumulative 3-year survival was 67.4% (95% confidence interval [CI] 64.5–70.3). For patients with positive ENT screening results ( $n = 61$ ) 3-year survival was 66.9% (95%CI 54.2–79.6), for patients with negative ENT screening results ( $n = 1038$ ) this was 67.4% (95%CI 64.5–70.3) (Figure S1). This difference did not reach statistical significance ( $p = .51$ ). As LT has a large influence on survival, we evaluated the proportion of patients who underwent LT. This was similar between both groups: 57% in patients with positive screening, and 58% in patients with negative screening. In only one case, the patient with the SCC in the neck with unknown primary, cause of death was directly related to ENT pathology detected during screening.

## 3.3 | ENT consultations after LT

A total of 711 patients were transplanted during the observation period, following a median waiting time of 239 days (IQR 91 - 386) between screening and transplantation. In this group, 638 patients underwent prior ENT screening, while 73 were not screened due to time restraints in acute liver failure ( $n = 67$ ) or for reasons unknown ( $n = 6$ ) (Figure 1). Following LT, 108 recipients (15.2%) were referred for ENT consultation during a median follow-up period of 5.1 years (IQR 2.5–8.4). The median time between LT and ENT consultation was 206 days (IQR 26 - 689). The majority of the consultations involved minor complaints, but in 18 patients a noteworthy diagnosis was made: vocal cord paralysis due to metastasized HCC, a pleomorphic adenoma in the

parotid gland (benign tumor with a small chance of malignant transformation), a squamous cell carcinoma of the oral cavity, a hypopharyngeal carcinoma, and 14 cases of sinusitis (Table 3; in-depth overview in Table S2).

In LT recipients, sinusitis was treated with local therapy (nasal rinsing, nasal steroid;  $n = 4$ ), oral antibiotics ( $n = 6$ ), or endoscopic sinus surgery ( $n = 3$ ), while one patient did not receive any treatment. Despite the fact that all these patients were using immunosuppressive drugs, none of the sinusitis cases resulted in any serious complications or mortality.

Both cases with a novel HNSCC after LT involved patients with alcoholic liver cirrhosis. The first patient was diagnosed with a T2N0M0 SCC of the oral cavity, which occurred 7.5 years after LT. He underwent surgical treatment but deceased one year thereafter, the cause of death is unknown. The second patient had a T2N0M0 hypopharyngeal carcinoma, diagnosed 4.6 years after LT. He was treated primarily with radiotherapy but developed pulmonary metastases after 4 years. He died due to respiratory failure resulting from a combination of myocardial infarction and pulmonary embolisms while under treatment of palliative chemotherapy.

### 3.3.1 | Unscreened patients and untreated sinusitis during screening

Two patients who were diagnosed with sinusitis after LT had already shown radiological signs of sinusitis during screening. They did not receive any treatment at that point but could be adequately managed after LT. None of the other patients with asymptomatic sinusitis during screening revisited the outpatient clinic after LT. Of the 73 patients who were not screened before LT, six patients were referred to the ENT clinic. None of these patients were diagnosed with sinusitis or a neoplasm.

## 4 | DISCUSSION

We evaluated routine ENT screening in a large cohort of Western European liver transplant candidates. The majority of findings during ENT screening were deemed irrelevant and did not influence listing decisions. In 61 of the 1099 screened patients, a (latent) infection, mostly sinusitis, or neoplasm was detected. After LT, no complicated sinusitis was observed, even in patients without ENT screening or previously untreated sinusitis.

In solid organ transplant recipients, the incidence of rhinosinusitis is reported to range between 1.3% and 11.0%.<sup>16,17</sup> Our study shows similar results, as 5.2% were diagnosed with sinusitis during screening (57 out of 1099 patients). Of note, most of the patients with radiological signs of sinusitis did not have any complaints, so referral based on symptoms alone would not identify these cases. Furthermore, it can be debated whether these patients without any symptoms comply with the diagnosis of sinusitis, as abnormal radiological findings in the paranasal sinuses are relatively common.<sup>18</sup> However, cases in our



**TABLE 3** All positive findings in ear, nose, and throat (ENT) consultations after liver transplantation (LT) (total group  $n = 711$ ) and their corresponding treatment. Patients were all referred due to specific complaints. None of the infections had a complicated course, despite the use of immunosuppressive drugs. Two sinusitis patients had radiological signs of sinusitis (full opacification or an air-fluid level) during screening before LT but were not treated accordingly. A more detailed overview can be found in Table S2. HCC: hepatocellular carcinoma; SCC: squamous cell carcinoma.

Subgroup	N	Detailed diagnosis	Treatment
Infections	14	Acute or chronic sinusitis: 13	Nasal rinsing and nasal steroid: 4
		Nasal polyps: 1	Oral antibiotics: 6
			Endoscopic sinus surgery: 3
			None: 1
Neoplasms	4	SCC oral cavity: 1	Surgery (commando procedure)
		Hypopharyngeal carcinoma: 1	Radiotherapy
		Pleomorphic adenoma lt parotid gland: 1	(Superficial) parotidectomy
		Vocal cord paralysis due to metastasized HCC: 1	Vocal cord augmentation

study were identified based on full opacification or an air-fluid level on radiography, which is a much rarer incidental finding and therefore more indicative of sinusitis.

The overall prevalence of HNSCC was low in our cohort of screened patients, 0.2% (two out of 1099 patients), in line with former observations in LT candidates.<sup>10,11</sup> Excessive alcohol or tobacco consumption has been previously related to the finding of HNSCC in LT candidates,<sup>10,11</sup> but this combination of risk factors was present in only one of the two patients.

In the cohort of LT recipients, we did not observe any complicated sinusitis. A previous study in a small cohort of liver and kidney transplant recipients reported similar results.<sup>19</sup> A large Korean study in liver transplant recipients confirmed the absence of complicated infections but found better survival in sinusitis patients who were adequately treated before transplantation.<sup>13</sup> Looking at other solid organ transplant recipients, a lower mortality was found in lung transplant recipients with sinusitis who underwent FESS prior to transplantation compared to those who did not, while the presence of abnormalities on sinus CT was not associated with mortality.<sup>20</sup> In contrast, the prevalence of sinusitis was not increased in a large cohort of kidney transplant recipients, nor did asymptomatic patients show any deterioration of clinical course after transplantation.<sup>21</sup> Literature on the decision to treat sinusitis before solid organ transplantation is thus somewhat conflicting. Of note, chronic hepatic disease is often accompanied by coagulopathy which can influence peri-operative bleeding and may impair results from FESS.<sup>22</sup>

In this cohort, two novel cases of HNSCC were detected after transplantation, accounting for a prevalence of 0.3%. Both of these patients had a history of excessive alcohol consumption and this was in fact related to the liver disease for which they underwent transplantation. Previous studies revealed similar results, that is, an increased risk of developing HNSCC after LT, especially in cases of alcoholic liver disease.<sup>8,9,23,24</sup>

Due to the retrospective nature of this study, there are obvious limitations. In several cases the file was incomplete and fiber endoscopic evaluation of the nasal cavity and larynx was not always performed, which may have resulted in an underestimation of the number of ENT diagnoses. Furthermore, a number of screening procedures were performed solely by radiological evaluation, so we do not know if these patients had any complaints at that time or may have had an undetected malignancy. The number of ENT diagnoses after LT may have been underestimated as recipients were not routinely evaluated by an ENT surgeon after LT. In addition, we cannot exclude any missing diagnosis due to patients visiting an ENT clinic elsewhere. However, these complex patients are usually referred within their own hospital so we do believe this would only constitute a small group and would not influence overall results. Last, follow-up after LT varies and is limited in the more recently transplanted group of patients. This could have resulted in an underestimation of especially post-transplant malignancies.

#### 4.1 | Future perspective of ENT screening

For HNSCC, the number needed to screen was very high (550), and whether this justifies screening is debatable. Although a personalized approach based on risk factors is preferred, these could not be extracted from our study due to the small number of cases. At present, the decision to screen for HNSCC will likely differ per center, based on background risk and availability of screening and grafts.

With respect to infections, there are several arguments that may oppose general ENT screening. First, having sinusitis at screening did not result in any complications after LT, nor did it influence survival. However, it should be noted that 19% of sinusitis patients underwent endoscopic sinus surgery prior to LT, the initiation of which was related to the severity of sinusitis. We therefore hypothesize that especially asymptomatic sinusitis patients may be managed more conservatively,

or that surgical treatment can be postponed until after LT. Second, none of the patients without ENT screening were referred for ENT consultation after LT, although these numbers were somewhat limited. And last, none of the patients with sinusitis after LT had a complicated course of the disease, indicating that this seldom leads to concern.

The costs involved in ENT screening mainly consist of consultation (\$190) and radiology exams (\$60 for conventional radiography and \$270 for CT). A rough estimate of yearly costs adds up to ~\$20k at our hospital. While this amount is not very high, omitting ENT screening will have the benefits of sparing valuable patient time, reducing unnecessary treatment, and simplifying the screening protocol.

We think an outcome-based critical appraisal of the screening procedure may lead to further reductions in the protocol, as has been already achieved with the number of colonoscopies.<sup>25</sup> Based on this study, we aim to reduce protocolled ENT screening at our institution by screening only in case of specific ENT complaints. Questionnaires addressing nasal complaints (i.e., nasal blockage, rhinorrhea, reduced smell, headache) may be of help in identifying these patients.

### AUTHOR CONTRIBUTIONS

Conceptualization: Eline Beukman, Adriaan J. van der Meer, Caroline M. den Hoed, and Andries Paul Nagtegaal. Investigation and data curation: Eline Beukman and Adriaan J. van der Meer. Formal analysis: Eline Beukman, Adriaan J. van der Meer, R. Bart Takkenberg, Caroline M. den Hoed, and Andries Paul Nagtegaal. Resources: Adriaan J. van der Meer, R. Bart Takkenberg, and Caroline M. den Hoed. Writing – original draft: Eline Beukman, Adriaan J. van der Meer, R. Bart Takkenberg, Caroline M. den Hoed, and Andries Paul Nagtegaal. Writing – review and editing: Adriaan J. van der Meer, R. Bart Takkenberg, Caroline M. den Hoed, and Andries Paul Nagtegaal.

### CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

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### DATA AVAILABILITY STATEMENT

Anonymized data files are available upon request to the corresponding author.

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### SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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