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Evaluation of infections in neurological diseases in a palliative care centre

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Abstract

In this study on neurologic diseases treated in palliative care, we aimed to identify the factors predisposing the sites in the body to develop infections and the factors affecting the quantities of growth in the cultures. The medical records of patients with neurologic diseases in the palliative care centre (PCC) were retrospectively reviewed covering the years between 2014 and 2018. The patient data including the age, gender, length of stay (LOS) in PCC; their diagnoses and comorbid diseases, nutritional status, pressure ulcers (PU) and their emergence; and the quantities of growth in blood, urine, wound, rectal, and tracheal aspirate cultures (TA) were collected and compared. One hundred and forty-three patients were included in the study. The highest quantity of growth was observed in urine cultures. The rates of growth were statistically higher in blood cultures of patients with a percutaneous endoscopic gastrostomy (PEG) and a tracheostomy ($p=0.001$, $p=0.013$). The quantities of growth in wound cultures were lower in the cancer patients, whereas, those in the wound and rectal cultures were significantly higher in the patients with PU. The growth quantities were higher in the TA cultures of the patients with hypoxic brain injury and tracheostomies ($p=0.033$, $p<0.001$). The rates of growth in the blood, urine, wound, and rectal cultures increased with increasing LOS in PCC. We suggest that prevention and management of infections are important in achieving relatively shorter LOS in PCC considering the chronic and progressive courses of neurologic diseases.

Keywords: Palliative care, infection, neurologic diseases, percutaneous endoscopic gastrostomy, tracheostomy

Introduction

The goal of palliative care is to reduce symptom burden on patients and families, suffering from progressive and chronic diseases, to provide them with psychosocial support, and to increase their quality of lives [1]. The World Health Organization described palliative care for the first time in 1986 as an approach to be provided to terminally ill patients when no treatment options remain. However; it has recently become a family support approach, which is started in parallel to the treatment at the time of diagnosis regardless of disease prognosis. Furthermore, it has evolved to a more comprehensive approach, serving not only to cancer patients but also to a wide range of patients suffering from disorders including dementia, Parkinson's disease, stroke, and motor neuron diseases; which are associated with lower mortality rates and higher life expectancies compared to cancer [2].

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Infections increase symptom burden and reduce quality of life in palliative care patients [3]. Since the primary goal of palliative care is to accomplish symptom control and to increase quality of life for patients and families, infection treatment is a critical issue. Infections are common complications in palliative care patients therefore management of infections is one of the major challenges in palliative care. It has been demonstrated in the literature that bacterial infections are common in advanced cancer or terminal illnesses and that they are associated with increased mortality [4,5]. Despite the high prevalence of palliative care infections, the indications and benefits of antimicrobial therapy have not been clarified [6]. Palliative care patients are prone to high risk of developing infections due to defects in their host defence mechanisms, multiple comorbidities, and interventional procedures [3]. Although it has not been established yet whether antimicrobial therapies for these infections provide symptomatic relief, importance of infection management in palliative care has become increasingly recognized [6-9].

Studies about infection control in palliative care are remarkably limited in the literature and there is considerably little information on causative factors [10]. In this study, we aimed to identify the sites of infections and the risk factors affecting the microbial

culture growth of the patients with neurological diseases managed in our hospital's palliative care centre (PCC).

Material and Methods

This study was conducted in compliance with the Declaration of Helsinki after being approved by the ethics committee of Ankara Numune Training and Research Hospital (26.06.2018/2081). Charts of the patients, who were treated in the PCC for the diagnosis of a neurological disorder in the period from 01.01.2014 to 31.12.2018, were retrospectively reviewed. Patients with growth of microorganisms in culture were included in the study.

Were only infectious agents included and colonization or contaminated growths excluded in the study. Culture results of the patients were evaluated by infectious diseases and antibiotic treatment was initiated by them according to the culture results.

Types of neurological disorders were categorized as cerebrovascular diseases (CVD), primary or metastatic brain cancers, hypoxic brain injury, alzheimer, parkinson's disease, traumatic brain injury, and motor neuron diseases (MND). Patients with more than one primary neurological disease were excluded from the study. Chronic obstructive pulmonary disease (COPD), heart failure (HF), hypertension (HT), and diabetes mellitus were taken as comorbidities diseases. Age and sex distribution of the patients, their diagnoses, the presence of comorbid diseases, interventional external openings to the internal organs like a percutaneous endoscopic gastrostomy (PEG) or tracheostomy, and pressure ulcers (PU) were noted. Length of patient stay at the PCC and patients' condition at the time of discharge from the PCC [death, transfer to intensive care unit (ICU), or transfer to home] were recorded. Growth in blood, urine, wound, rectal, and tracheal aspirate (TA) cultures were noted.

Statistical Analysis

Conformity of the continuous variables (age and length of stay in PCC) to a normal distribution was tested with graphical methods and the Kolmogorov-Smirnov test. The chi-square test was used for investigating the relationship of binary independent categorical variables. Pearson Chi-Square analysis was used. In cases where the expected value assumption was not provided in the Pearson Chi-Square analysis, Fisher's Exact test was used.

A logistic regression analysis was performed to identify the potential factors likely to affect the growth in culture. "Enter" method was used in logistic regression analysis. The categorical variables and frequency distributions were listed in numbers (n) and percentages (%). The numerical variables were presented as mean±standard deviation. All statistical calculations and analyses were performed with MS-Excel 2010, IBM SPSS Statistics Ver. 23.0 (IBM Corp. IBM SPSS Statistics for Windows, Armonk, NY: IBM Corp.). A p-value of <0.05 was accepted to Indicate Statistical Significance.

Results

The charts of the patients treated with a diagnosis of a neurological disorder in the years from 2014 to 2018 in the PCC of Ulus Public Hospital were reviewed. Of them, 5 patients with missing data were excluded. A total of 143 patients with growth of microorganisms in culture were included in the study. Of the included patients, 60 were females and 83 were males. Mean age was 66.4±19.3 years and mean length of PCC stay was 42.3±57.7 days. Thirty-four patients died at PCC, 42 were transferred to the ICU, and 67 were transferred home (Table 1).

Table 1. Demographic characteristics of patients

Ages (Years)*		66.44±19.37
Gender**		
	Female	60 (41.96)
	Male	83 (58.04)
LOS in PCC (days)*		42.32±57.77
Discharge**		
	Exitus	34 (23.77)
	ICU	42 (29.37)
	Home	67 (46.85)

*Values are presented as mean ± standard deviation. **Values are presented as n (%).
LOS in PCC: Length of Stay in PCC, ICU: Intensive Care Unit

The most common diagnosis was CVD (n=60, 41.95%) followed by alzheimer (n=29; 20.27%), cancer (n=24; 16.78%), TBI (n=20 13.98%), hypoxic brain injury (n=14; 9.79%), Parkinson's disease (n=10; 6.99%), and MND (n=9; 6.29%), respectively. The most common comorbid disease was HT (n=50; 34.96%) followed by DM in 29 patients, HF in 12 patients, and COPD in 5 patients. Pressure ulcers (67.13%) and PEG (%51.74) were present in more than half of the patients. A tracheostomy was present in 50 (34.96%) patients (Table 2).

Table 2. Diagnosis and comorbidities of patients

Variable	n (%)
Diagnosis	
Ca	24 (16.78)
CVD	60 (41.95)
Alzheimer	29 (20.27)
CH	14(9.79)
PD	10 (6.99)
MND	9 (6.29)
TBI	20 (13.98)
Comorbidities	
COPD	5 (3.49)
HF	12 (8.39)
HT	50 (34.96)
DM	29 (20.27)
PEG	74 (51.74)
Tracheostomy	50 (34.96)
PU	96 (67.13)

Values are presented as n (%).
Ca: Cancer, CH: Cerebral Hypoxia, COPD: Chronic Obstructive Pulmonary Disease, CVD: Cerebrovascular Disease, DM: Diabetes Mellitus, HF: Heart Failure, HT: Hypertension, MND: Motor Neuron Disease, PD: Parkinson's Disease, PEG: Percutaneous Endoscopic Gastrostomy, PU: Pressure Ulcer, TBI: Traumatic Brain Injury

Bacterial growth occurred in the urine cultures most commonly (77.62%) and this was followed by the blood (46.15%) and wound (41.95%) cultures, respectively. Least amount of growth was observed in the rectal (19.58%) and TA (19.58%) cultures (Table 3). There was a significantly lower rate of growth in blood cultures in patients with HT, statistically significantly more growth was observed in patients with PEG and tracheostomy (p=0.001, p=0.013). While growth in the wound cultures of cancer patients was rare (16.67%; p=0.007), growth in the wound (61.46%; p=0.000) and rectal cultures (p=0.005) of the patients with PU were significantly common. Also, TA culture growth occurred more commonly in patients with hypoxic brain injury and tracheostomy (p=0.033, p<0.001) (Table 4).

Table 3. Overall results of cultures

Type of culture	n	%
Blood	66	46.15
Urine	111	77.62
Wound	60	41.95
Rectal	28	19.58
Tracheal Aspirate	28	19.58

Table 4. Comparison of culture results according to diagnosis and co-morbidities of the patients

		Blood		Urine		Wound		Rectal		ETA	
		n (%)	p	n (%)	p	n (%)	p	n (%)	p	n (%)	p
Ca	Present	8 (33.33)	0.178	17 (70.83)	0.425	4 (16.67)	0.007	5 (20.83)	0.785	5 (20.83)	0.785
	Absent	16 (66.67)		7 (29.17)		20 (83.33)		19 (79.17)		19 (79.17)	
CVD	Present	29 (48.33)	0.611	44 (73.33)	0.366	24 (40.00)	0.732	14 (23.33)	0.319	9 (15.00)	0.255
	Absent	31 (51.67)		16 (26.67)		36 (60.00)		46 (76.67)		51 (85.00)	
Alzheimer	Present	12 (41.38)	0.590	22 (75.86)	0.861	13 (44.83)	0.699	4 (13.79)	0.390	2 (06.90)	0.056
	Absent	17 (58.62)		7 (24.14)		16 (55.17)		25 (86.21)		27 (93.10)	
COPD	Present	3 (60.00)	0.661	3 (60.0)	0.323	2 (40.00)	1.000	2 (40.00)	0.250	2 (40.00)	0.250
	Absent	2 (40.00)		2 (40.00)		3 (60.00)		3 (60.00)		3 (60.00)	
CH	Present	10 (71.43)	0.043	12 (85.71)	0.524	8 (57.14)	0.216	3 (21.43)	0.736	6 (42.86)	0.031
	Absent	4 (28.57)		2 (14.29)		6 (42.86)		11 (78.57)		8 (57.14)	
PD	Present	4 (40.00)	0.754	8 (80.00)	0.817	6 (60.00)	0.320	0	0.210	2 (20.00)	1.000
	Absent	6 (60.00)		2 (20.00)		4 (40.00)		10 (100.0)		8 (80.00)	
MND	Present	6 (66.67)	0.301	8 (88.89)	0.685	5 (55.56)	0.491	2 (22.22)	0.687	3 (33.33)	0.377
	Absent	3 (33.33		1 (11.11)		4 (44.44)		7 (77.78)		6 (66.67)	
TBI	Present	9 (45.00)	0.936	15 (75.00)	0.780	9 (45.00)	0.745	3 (15.00)	0.765	4 (20.00)	1.000
	Absent	11 (55.00)		5 (20.00)		11 (55.00)		17 (85.00)		16 (80.00)	
HF	Present	7 (58.33)	0.364	8 (66.67)	0.471	4 (33.33)	0.541	4 (33.33)	0.249	2 (16.67)	1.000
	Absent	5 (41.67)		4 (33.33)		8 (66.67)		8 (66.67)		10 (83.33)	
HT	Present	16 (32.00)	0.015	38 (76.00)	0.822	20 (40.00)	0.767	11 (22.00)	0.572	6 (12.00)	0.100
	Absent	34 (68.00)		12 (24.00)		40 (60.00)		39 (78.00)		44 (88.00)	
DM	Present	12 (41.38)	0.590	23 (79.31)	0.749	13 (44.83)	0.699	9 (31.03)	0.078	4 (13.79)	0.390
	Absent	17 (58.62		6 (20.69)		16 (55.17)		20 (68.97)		25 (86.56)	
PEG	Present	44 (59.46)	0.001	57 (77.03)	0.987	36 (48.65)	0.081	14 (18.92)	0.870	19 (25.68)	0.052
	Absent	30 (40.54)		17 (22.97)		38 (51.35)		60 (81.08)		55 (74.32)	
Trach	Present	30 (60.00)	0.013	42 (84.00)	0.150	23 (46.00)	0.442	10 (20.00)	0.902	22 (44.00)	<0.001
	Absent	20 (40.00)		8 (16.00)		27 (54.00)		40 (80.00)		28 (56.00)	
PU	Present	49 (51.04)	0.076	74 (77.08)	1.000	59 (61.46)	<0.001	25 (26.04)	0.005	20 (20.83)	0.551
	Absent	47 (48.96)		22 (22.92)		37(38.54)		71 (73.96)		76 (79.17)	

ETA: Endotracheal Aspirate, Ca: Cancer, CH: Cerebral Hypoxia, COPD: Chronic Obstructive Pulmonary Disease, CVD: Cerebrovascular Disease, DM: Diabetes Mellitus, HF: Heart Failure, HT: Hypertension, MND: Motor Neuron Disease, PD: Parkinson's Disease, PEG: Percutaneous Endoscopic Gastrostomy, PU: Pressure Ulcer, Trach: Tracheostomy, TBI: Traumatic Brain Injury

Logistic regression analysis, conducted to identify the potential factors involved in the microbial growth in the cultures, revealed that; as the length of hospital stay increased, the rates of growth in the blood (OR=1.028; p<0.001), urine (OR=1.016; p=0.014), and rectal (OR=1.019; p=0.003) cultures increased. However; growth occurrence was low in the wound cultures of cancer patients compared to other study patients with PU (OR=0.182; p=0.033). Logistic regression analysis was controlled with the Omnibus test and the significance of the model was demonstrated by finding p <0.001 (Table 5).

Table 5. Variables related to growth quantities in the cultures: logistic regression analysis

Variables		β	p-value	OR (95% CI)
Blood	LOS in PCC	0.028	<0.001	1.028 (1.013-1.044)
Urine	LOS in PCC	0.027	0.014	1.027 (1.005-1.049)
	LOS in PCC	0.016	0.005	1.016 (1.005-1.027)
Wound	Cancer	-1.703	0.033	0.182 (0.038-0.871)
Rectal	LOS in PCC	0.019	0.003	1.019 (1.007-1.032)

OR: odds ratio, CI: Confidence Interval. P < 0.05, LOS in PCC: Length of Stay in PCC

Discussion

Studies in the literature report infection incidence in the neurological ICU as 20 to 30% and that this high incidence is associated with longer hospital stay and increased rates of morbidity and mortality [11,12]. Vitettave et al. investigated the incidence and sites of bacterial infections in 102 patients, who died in a palliative care unit.3 In line with our study results, the authors reported that the most common type was urinary infections (42.5%), followed by respiratory tract (22.9%), blood (12.5%), skin and subcutaneous tissue infections (12.5%) [13].

In our study; we observed the most common growth in urinary cultures (77.62%) followed by blood (46.15%) and wound (41.95%) cultures respectively. The two least occurrences of growth were observed in rectal (19.58%) and TA (19.58%) cultures. A study on 255 advanced cancer patients reported urinary tract (n=54), respiratory tract (n=5), mouth/pharynx (n=13), and skin/subcutaneous tissue (n=12) infections. The same study also reported that antimicrobial therapy had no effect on survival but was efficacious in providing symptom control [13]. In agreement with the findings of that study, the highest growth rate occurred in urine cultures; which can be explained by the presence of indwelling urinary catheters in all of our study patients. Despite the presence of urinary catheters in all patients; a tracheostomy was present only in 34.96% of our study population and there were no patients on mechanical ventilators, explaining the lower rate of growth in the TA cultures compared to the urinary cultures. According to the literature rapid clinical improvement is not expected in patients with anoxic/hypoxic brain injuries and gastrostomies and tracheostomies are common in these patients. Furthermore, it is reported that growth in TA culture is more common in patients with PEGs and tracheostomies [14,15]. It is well-known that tracheostomy cannulas are external openings to the lower respiratory tract, leading to the development of infections by providing direct access to viruses and bacteria. Also, it is recognized that they cause a local inflammatory reaction, increasing the risk of developing infections [16,17]. In our study, growth in blood cultures was more common in patients with PEGs and tracheostomies. Similarly and in line with the literature, we observed that growth in the TA cultures was more common in patients with hypoxic brain injury and tracheostomies. Lusuardi et al. [17] reported that chronic tracheostomy patients were prone to bacterial colonization in the respiratory airways, which is a risk factor for developing respiratory tract infections.

We observed a significantly lower rate of growth in wound cultures in cancer patients; however, growth in wound and rectal cultures was significantly high in patients with PUs. We suggest that the short life expectancy in cancer may cause a shorter hospital stay in patients and potentially contribute to the lower rates of their PU infections. The lower growth rate in the wound cultures of cancer patients might be paradoxically associated with their poor prognosis and lower life expectancy in contrast to the higher growth rates found in neurological diseases with comparably higher life expectancy like Parkinson's disease [18,19]. The logistic regression analysis revealed that the growth in blood, urine, wound, and rectal cultures increased by 1.028, 1.027, 1.016, and 1.019 folds respectively and showed statistical significance as the length of hospital stay increased. The study by Halperin et al. [20] reports longer length of stay in the neurological ICU in patients with urinary tract infections compared to other patients, supporting our study finding that urinary tract infections and a longer length of hospital stay are associated. Other studies in the literature support this finding; a study investigating the effects of nosocomial infections on mortality, length of hospital stay, and costs of hospitalization found that patients with infection had 1.5 times longer hospital stay compared to those individuals without infections (29.2 days vs.20.2 days, respectively) [21]. Gleeson et al. [22] conducted a study on palliative care patients and reported that methicillin-resistant S. aureus positive patients had significantly long PCC stay and had a high number of infection episodes.

Conclusion

We identified that growth of microorganisms occurred most commonly in the urine cultures of the neurology patients treated in our PCC. Growth was more common in the blood samples

collected from patients with a PEG and a tracheostomy. In patients with hypoxic brain injury and tracheostomy, microbial growth most commonly occurred in TA cultures. As the length of stay in PCC got longer; growth in the blood, urine, wound, and rectal cultures increased significantly. Considering the chronic and progressive nature of neurological diseases, we suggest that a shorter length of stay in the PCC will play a significant role in the prevention and management of infections.

Conflict of interests
The authors declare that they have no competing interests.

Financial Disclosure
All authors declare no financial support.

Ethical approval
Ankara Numune Training and Research Hospital (26.06.2018/2081).

References

1. World Health Organization (WHO). WHO Definition of Palliative CareAvailable at: http://www.who.int/cancer/palliative/definition/en/ access date 30 September 2020.
2. Boersma I, Miyasaki J, Kutner J et al. Palliative care and neurology: time for a paradigm shift. Neurology. 2014;83:561-7.
3. Vitetta L, Kenner D, Sali A. Bacterial infections in terminally ill hospice patients. J Pain Symptom Manage. 2000;20:326-34.
4. Datta, R, Juthani-Mehta M. Burden and management of multidrug-resistant organisms in palliative care. Palliat Care. 2017;10:1178224217749233.
5. Homsi J, Walsh D, Panta R et al. Infectious complications of advanced cancer. Support Care Cancer. 2000;8:487-92.
6. Rosenberg JH, Albrecht JS, Fromme EK et al. Antimicrobial use for symptom management in patients receiving hospice and palliative care: a systematic review. J Palliat Med. 2013;16:1568-74.
7. Reinbolt RE, Shenk AM, White PH et al. Symptomatic treatment of infections in patients with advanced cancer receiving hospice care. J Pain Symptom Manage. 2005;30:175-82.
8. Baghban A, Juthani-Mehta M. Antimicrobial use at the end of life. Infect Dis Clin North Am. 2017;31:639-47.
9. Juthani-Mehta M., Malani PN, Mitchell SL. Antimicrobials at the end of life: an opportunity to improve palliative care and infection management. Jama. 2015;314:2017-8.
10. Yajima R, Ise Y, Wako T et al. A retrospective study of risk factors for infection in cancer patients receiving specialist palliative care. J Nippon Med Sch. 2013;80:481-5.
11. Rivera-Lara L, Ziai W, Nyquist P. Management of infections associated with neurocritical care. Handb Clin Neurol. 2017;140:365-378.
12. O'Horo JC, Sampathkumar P. Infections in Neurocritical Care. Neurocrit Care. 2017;27:458-67.
13. White PH, Kuhlenschmidt HL, Vancura BG et al. Antimicrobial use in patients with advanced cancer receiving hospice care. J Pain Symptom Manage. 2003;25:438-43.
14. Schönenberger S, Al-Suwaidan F, Kieser M et al. The SETscore to predict tracheostomy need in cerebrovascular neurocritical care patients. Neurocrit Care. 2016;25:94-104.
15. Allareddy V, Rampa S, Nalliah RP, et al. Prevalence and predictors of gastrostomy tube and tracheostomy placement in anoxic/hypoxic ischemic encephalopathic survivors of in-hospital cardiopulmonary resuscitation in the united states. PLoS One. 2015;10:e0132612.
16. Pignatti P, Balestrino A, Herr C et al. Tracheostomy and related host-pathogen interaction are associated with airway inflammation as characterized by tracheal aspirate analysis. Respir Med. 2009;103:201-8.
17. Lusuardi M, Capelli A, Cerutti CG et al. Influence of clinical history on airways bacterial colonization in subjects with chronic tracheostomy. Respir Med. 2000;94:436-40.
18. Davies E, Higginson I (eds). Palliative care. The solid facts. http://www.euro.who.int/__data/assets/pdf_file/0003/98418/E82931.pdf access date 29 September 2020.
19. Lynn J, Adamson DM. Living well at the end of life. Adapting health care to serious chronic illness in old age. RAND CORP SANTA MONICA CA.2003
20. Halperin JJ, Moran S, Prasek D et al. Reducing hospital-acquired infections among the neurologically critically Ill. Neurocrit Care. 2016;25:170-7.
21. Kaye KS, Marchaim D, Chen TY et al. Effect of nosocomial bloodstream infections on mortality, length of stay, and hospital costs in older adults. J Am Geriatr Soc. 2014;62:306-11.
22. Gleeson A, Larkin P, Walsh C et al. Methicillin-resistant Staphylococcus aureus: Prevalence, incidence, risk factors, and effects on survival of patients in a specialist palliative care unit: A prospective observational study. Palliat Med. 2016;30:374-81.