Case report

The cost of a recalcitrant intravenous drug user with serial cases of endocarditis: Need for guidelines to improve the continuum of care

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\textbf{A R T I C L E   I N F O}

Article history:
Received 17 January 2017
Received in revised form 2 February 2017
Accepted 3 February 2017

Keyword:
IV substance use disorder with life-threatening infection

\textbf{A B S T R A C T}

We report a case of an intravenous drug user (IVDU) patient who had 4 episodes of endocarditis within a 2-year time period in rural Georgia. The institutional cost was approximately $380,000. The lack of an established transitional care plan for IVDUs to outpatient care is a common phenomenon at institutions. Guidelines are essential to optimize the quality of care rendered to IVDUs with such infections, to assist providers in utilizing limited resources, and to limit the cost to the institutions.

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\textbf{Introduction}

Little data exist on the management of intravenous drug use (IVDU) when treating severe infectious diseases (ID), which necessitate parenteral antimicrobial therapy in rural communities. Rural communities lack specialists in infectious diseases, addiction, or ethics to guide quality initiatives in managing infectious diseases in IVDU. Standard guidelines offer appropriate antimicrobial therapy recommendations; however, the means for optimization of treatment adherence and to prevent use of central access for intravenous (IV) drug injection is much less clear. Quality initiatives to improve the transition of care of IVDUs with infections into the community to receive parenteral therapy are likewise lacking. Identifying patients with IVDU is essential to optimal management \cite{1,2}. Mertz et al. \cite{3} reported that appropriate antimicrobial therapy in hospitalized patients with IVDU is practical and successful though disease courses are complicated and readmissions are common. The absence of an established approach in managing such patients is daunting where the availability of rehabilitative and supportive resources in the community for addicts is scarce. The cost of not having a transitional mechanism in place has not been previously reported.

We report a case of a patient who had 4 episodes of endocarditis within a 2-year time period. Her nonadherence with IVDU treatment recommendations adversely affected her outcome from a drug addiction perspective and had a negative financial impact on the institution and providers. This case of serial episodes of endocarditis in one IVDU exemplifies the importance of an institution’s need to design protocol driven, pre-emptive transitional plans addressing management of life-threatening infections in its community before the need for out-patient parenteral therapy (OPAT) arises in IVDUs.

\textbf{Case report}

The patient was a 45-year-old woman with a history of active oral and parenteral opioid drug use and chronic hepatitis C infection. She presented to our rural community hospital in southeast Georgia 7 times over a 2-year time period with 4 different episodes of native valve endocarditis as defined by Duke Criteria \cite{4,5}. In Table 1, the hospitalizations comparing ID diagnosis, psychiatric evaluations and adherence are summarized.

In July 2014, she presented with group A streptococcal endocarditis. She received parenteral ampicillin for 3 weeks and was discharged home on oral levofloxacin to complete a 42-day course of treatment. She was readmitted with altered mental status 2 weeks later only to be discharged again on levofloxacin. The patient did not return for scheduled follow-ups.

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In December 2014, she presented with methicillin-resistant *Staphylococcus aureus* (MRSA) mitral valve endocarditis and had evidence of septic emboli and paraspinal/gluteal abscesses. She underwent incision, drainage, and washout of a pinned knee at a tertiary center. On her return to the rural hospital to complete the 42 days of parenteral vancomycin, psychiatry was consulted. She was diagnosed with a severe opioid use disorder according to Diagnostic and Statistical Manual of Mental Disorders-5 [6] and was considered to be high-risk for manipulation of a peripherally inserted central catheter (PICC) line in the outpatient setting. Residential addiction treatment was advised on discharge. She was declined by drug rehabilitation programs. She was uninsured. All 56 days of parenteral therapy was given in the hospital. Post discharge she failed to enter addiction treatment.

In June 2015, she presented with methicillin sensitive *Staphylococcus aureus* (MSSA) septicemia. TEE did not reveal vegetation. Given her non-adherence with prior recommendations, antimicrobial management was again in the hospital. Only 17 days of the recommended 28 day of oxacillin therapy was completed because she left against medical advice. Commitment for addiction treatment was entertained by the psychiatrist; however legal counsel of the hospital did not favor such an approach. An established ethics committee was non-existent. The patient declined the local methadone maintenance program. She favored buprenorphine/suboxone agonist treatment, but such a provider (within a 50 mile radius) was not accepting new patients.

In October 2015, the patient was hospitalized with MSSA endocarditis and treated for only 35 of the 42 recommended days of oxacillin therapy. She left against medical advice. The antibiogram of the MSSA was similar to the strain isolated in June 2015, suggesting a relapse of that infection.

In April 2016, she presented directly to a tertiary center and was diagnosed with a penicillin-nonsusceptible alpha hemolytic streptococcus endocarditis of the mitral valve, which was treated with parenteral gentamicin for 10 days and parenteral ceftriaxone for 42 days. A contract between the ID consultant and the patient was signed which delineated that she would be adherent with home care visitations, would not access the PICC line for drug use, and would allow guardianship by her father. A zero tolerance policy of PICC abuse was included in the therapeutic contract. She was discharged home. Within one month she arrived to the rural hospital overdosed on opioids requiring mechanical ventilator support and vasopressor support. Bacterial cultures were negative. She completed the ceftriaxone course. She was transferred to third hospital for decompensated congestive heart failure from severe mitral regurgitation and underwent a tissue mitral valve replacement. She was lost to follow-up after this intervention.

This patient was uninsured. The hospital expenses (Medicare Part A and Medicaid but not Medicare Part B component of charges) were approaching $380,000, including 20 encounters and 5 hospitalizations. Providers’ fees and cardiothoracic surgery costs, which were performed in an outside facility, were not included in this sum of monies.

**Discussion**

Little has been written on the OPAT options for patients who have active IV drug use disorders in rural communities where resources are especially limited [7]. The Infectious Disease Society of America (IDSA) practice guideline for OPAT of endocarditis centers on the timing of complications such as embolization of the vegetation and the pathogens responsible for the infection [8,9]. Advice is rendered that injection drug use or alcohol use problems should be specifically evaluated before OPAT therapy is initiated. Indeed a safe and successful treatment of IVDU in a patient with a PICC in an outpatient treatment center was reported by Ho et al. [7]. Also, a retrospective observational study of patients with IVDU on OPAT demonstrated high cure rates (73.3%) [10]. ID providers are equipped to potentially handle these infections in restricted and outpatient settings. However, identifying and managing the addiction is the focal point of all medical care among IVDUs. Involvement of psychiatry early in the hospitalization and the creation of a transitional care plan are critical for successful medical care within the restraints of local resources and monies. Our patient had more successful ID treatment courses while in a restricted setting where illicit drugs were not accessible, but it was costly to the institution at $380,000 excluding cardiac surgery and provider fees.

Psychiatry played a large role in this patient’s care. However, an institutional transitional care plan for such circumstances was non-existent. As the opioid addiction epidemic has expanded to all communities, medical specialists need to lead their institutions to design locally a transitional care guideline to aid the management of IVDU patients with severe infections into the community. Risk stratification in regards to the degree of addiction and probability of compliance should be addressed. If risk is deemed at an acceptable level to discharge the patient from the hospital, an oversight management team and plan should exist. Unfortunately, most rural communities lack the specialist providers to initiate such a quality initiative which means practice guidelines need to

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**Table 1**

| Hospitalization | ID Diagnosis           | Microorganism       | Psych Evaluation/Clearance for PICC-OPAT | ID Recommendation | ID Compliance | Psych Compliance |
|-----------------|------------------------|---------------------|------------------------------------------|--------------------|--------------|-----------------|
| First Hospitalization | Mitral valve endocarditis | Group A Streptococcus | No/No                                    | 42 days oral antibiotics | No            | N/A             |
| Second Hospitalization | Mitral valve endocarditis | Group A Streptococcus | No/No                                    | 42 days oral antibiotics | No            | N/A             |
| Third & Fourth Hospitalization (Including transfer to tertiary care facility and return) | Native valve endocarditis | MRSA | Yes/No | 56 days IV antibiotics | Yes (in restricted setting) | No |
| Fifth Hospitalization | MSSA bacteremia | MSSA | Yes/No | 28 days IV antibiotics | No, and left AMA on Day 17 | No |
| Sixth Hospitalization | MSSA endocarditis | MSSA | Yes/No | 42 days IV antibiotics | No, and left AMA on Day 35 | No |
| Seventh Hospitalization | Streptococcus viridans endocarditis | Streptococcus viridans | No/Yes with contract | 42 days IV antibiotics | Yes (in restricted setting) | No |

Abbreviations: AMA: against medical advice; Compliance: adherence; ID: Infectious Diseases; IV: intravenous; MRSA: methicillin-resistant *Staphylococcus aureus*; MSSA: methicillin sensitive *Staphylococcus aureus*; N/A: not available; OPAT: outpatient parenteral antibiotic therapy; PICC: peripherally inserted central catheter.
be established which can be modified locally. An addiction specialist consultation early in the hospital is needed. That assessment would include:

1. the likelihood of outpatient compliance with abstinence and the treatment program designed by the psychiatrist and ID specialist.
2. Risk assessment of line manipulation for drug use is indicated.
3. Commitment for addiction treatment by the patient which may or may not include a contract.
4. Define alternative routes of management options available in the community and institution in the event the patient is defined high-risk for outpatient care. A consensus in management by providers would facilitate the optimization of care in this challenging population and limit the cost to institutions.

Conclusion

This case report illustrates the concept that much of adult infectious diseases are determined by the underlying medical conditions, complications of medical treatments or procedures. If a physician does not manage those underlying conditions and predisposing risks, management and prevention of the secondary infection are prone to fail. In this case, the primary disorder is the substance use disorder. The lack of a transitional care plan into the community to rehabilitative services rendering parenteral antimicrobials cost the institution $380,000. All infections were cured but the primary disorder was not able to be managed in the community. Practice guidelines and/or institutions need to address this gap in care of IVDUs with life-threatening infections to reduce cost and address the primary disorder.

Conflicts of interest

None.

Funding source

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

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