BRIEF COMMUNICATION

Use of Low-Molecular-Weight Heparin During Dental Extractions in a Medicaid Population

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ABSTRACT

BACKGROUND: Evidence-based guidelines recommend against discontinuation of oral anticoagulation therapy during most dental procedures because severe bleeding complications are rare and there is an increased risk for thromboembolic events in patients for whom warfarin therapy is interrupted. Although interruption of oral anticoagulation and bridge therapy with low-molecular-weight heparin (LMWH) may be indicated for high-risk individuals undergoing certain procedures, the use of LMWH in tooth extractions is expensive and often unnecessary.

OBJECTIVE: The purpose of this review was to identify and characterize procedural use of LMWH for dental extractions with respect to current consensus recommendations.

METHODS: The Idaho Medicaid pharmacy and medical claims database was queried to identify patients with a tooth extraction procedure between February 1, 1998, and January 31, 2005. Patients on warfarin therapy for 2 months before tooth extraction were identified as were claims for LMWH within 30 days before the procedure or 5 days after. Patient profiles were reviewed to determine number of extractions, rate of LMWH use, indication for anticoagulation, and associated drug costs.

RESULTS: Of 55,260 Medicaid patients who had a tooth extraction, 518 (0.9%) had received warfarin for at least 2 consecutive months before the tooth extraction procedure. Of these, 31 patients (6%) received LMWH therapy at the time of extraction for a total of 35 procedures. All procedures selected for review carried a low bleeding risk, with an average of 1.3 teeth extracted per procedure. The indications for anticoagulation included 16 procedures (45.7%) involving patients with a history of a thromboembolic event more than 90 days before the procedure, 10 procedures (28.5%) involving patients with a prosthetic valve, 4 procedures (11.4%) involving anticoagulated patients with atrial fibrillation, and 5 procedures (14.2%) involving patients with a history of thromboembolism fewer than 3 months before the procedure. LMWH costs for these 35 extractions totaled $22,294, or an average of $637 per procedure or $474 per extracted tooth. Enoxaparin was used in all but 1 of the procedures, with an average 5-day supply (average 8 enoxaparin units) dispensed per procedure. The costs associated with the required additional drug monitoring, e.g., INR monitoring, were not included in this analysis.

CONCLUSION: Although the overall number of dental procedures in anticoagulated patients using LMWH was small in our review, this inappropriate use resulted in avoidable costs to this Medicaid program.

KEYWORDS: Anticoagulation, Warfarin, Low-molecular-weight heparin, Dental extraction

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A therapeutic dilemma exists when it comes to the appropriate management of anticoagulated patients who are required to undergo certain medical or dental procedures. Particularly in the case of uncomplicated dental procedures such as tooth extractions, evidence-based guidelines advise against discontinuation of oral anticoagulation therapy.[1] A review of more than 700 case reports indicates few severe bleeding complications but severe thromboembolic complications in patients for whom therapy is interrupted.[2] Although interruption of oral anticoagulation and "bridge therapy" with low-molecular-weight heparin (LMWH) may be indicated for high-risk individuals undergoing certain procedures (e.g., patients with mechanical valves or those who experienced a recent thromboembolic event), LMWH use in tooth extractions is expensive, often unnecessary, and not generally recommended.

A perceived risk of serious bleeding is the most often cited reason for discontinuing or modifying the warfarin therapy of continuously anticoagulated patients undergoing dental procedures, even though a review of the literature yields evidence to the contrary.[3,4] While severe bleeding has been reported, reviews indicate that this occurs in less than 2% of cases.[2] Many clinicians and dentists often associate experiences in general surgical procedures with those in tooth extractions, therefore magnifying the risk of complications, primarily bleeding. Another motive behind discontinuation of oral anticoagulation is the decreased amount of blood in the surgical field, allowing improved visual evaluation of the procedure.[3]

In reality, the more prevalent concern with discontinuation of anticoagulant therapy is the risk of thrombosis.[2,4] Rates of thrombosis in patients whose anticoagulation therapy is

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interrupted are difficult to determine due to lack of conclusive evidence; however, patients with mechanical valves and those who experienced a thromboembolic event within 3 months before the discontinuation of anticoagulation are considered to be at high risk for new or recurrent thromboembolism. In contrast, patients who are anticoagulated for indications such as atrial fibrillation are at much lower risk.[1]

Current guidelines from the American College of Chest Physicians recommend against warfarin discontinuation during both routine dental procedures (i.e., cleanings, fillings, and crowns) as well as during more invasive surgical procedures (i.e., tooth extractions and gingival surgery) on the basis of few reported bleeding complications and an increased risk for thromboembolic events.[1,2,4] Control of local bleeding with tranexamic acid mouthwash or epsilon amino caproic acid mouthwash is also often recommended since studies have shown that these mouthwashes have allowed the patient to continue to use anticoagulation therapy successfully during dental procedures.[1,4-6]

Anticoagulated patients should receive regular monitoring of the international normalized ratio (INR). However, the importance of the INR in anticoagulated patients undergoing dental procedures is not clear. A 2001 study involving 249 patients who underwent 543 dental procedures showed that the incidence of postoperative bleeding in anticoagulated patients was not significantly influenced by the INR value. Patients were divided into 5 groups, based on the INR taken on the day of the dental procedure. Groups 1-4 included patients with INR values of 1.5-1.99, 2.0-2.49, 2.5-2.99, and 3.0-3.49, respectively. Group 5 included patients with an INR greater than 3.5. This group included 23 patients and 43 extractions. Three patients (13%) experienced postoperative bleeding. This was not a statistically significant increase in postoperative bleeding compared with the other 4 groups analyzed, and the author concluded that dental procedures could be conducted without alteration in anticoagulation therapy.[7]

LMWH is an important option to consider in patients whose oral anticoagulation must be interrupted because of the potential for procedure-related bleeding complications but whose risk level necessitates continued protection from thromboembolism. The use of this so-called bridge therapy is indicated for high-risk individuals (i.e., patients with prosthetic valves) undergoing invasive procedures (i.e., knee/hip replacement or abdominal surgery). Because the majority of dental surgeries are not considered invasive, the use of LMWH bridge therapy in patients undergoing such procedures is unnecessary.[1]

In the cases in which bridge therapy is appropriate, proper dosage of LMWH therapy is imperative for appropriate anticoagulation. Treatment guidelines recommend full-dose LMWH therapy for those patients with high thromboembolic risk, while prophylactic doses of LMWH are used in patients considered to have intermediate thromboembolic risk (patients not considered low or high risk).[1] Though more convenient than unfractionated heparin from a monitoring and administration standpoint, LMWH requires once- or twice-daily painful abdominal injections, which are also expensive (approximately $20 to $98 per day, based on dosage and number of daily injections).[8,9] Despite the high cost of LMWH, its appropriate use has been associated with economic savings in preventing thromboembolic events.[9]

With the available evidence discouraging both the interruption of oral anticoagulation or the use of LMWH bridge therapy in patients undergoing minimally invasive dental procedures (e.g., 1 or more tooth extractions), and the high cost of LMWH treatment, our review focused on the inappropriate management of anticoagulated patients in a Medicaid population and the potential cost savings when guidelines are observed.

Methods

A retrospective analysis of the Idaho Medicaid pharmacy and medical claims database was conducted for the 7-year period from February 1, 1998, through January 31, 2005. Over this time period, prescribers were not constrained by formulary restrictions or prior authorization criteria, and Medicaid recipients had no copayments or other drug-related costs. The first LMWH, enoxaparin (Lovenox), became available on the U.S. market in 1998, and others in the class (e.g., dalteparin [Fragmin], fondaparinux [Arixtra], and tinzaparin [Innohep]) were likewise available to Medicaid patients without restriction or copayment throughout the review period. In addition, consensus guidelines regarding appropriate management of anticoagulated patients remained consistent during the study period.

The database was queried to identify patients with 1 or more tooth extraction procedures based on Current Dental Terminology coding (Table 1). Dental procedure codes were limited to those representing extractions, including those surgical in nature, to ensure that only procedures with a low risk of bleeding were reviewed. More complicated surgical procedures, such as those involving the sinuses, were not included in the analysis because recommendations for anticoagulation and bridge therapy differ, depending on risk factors.

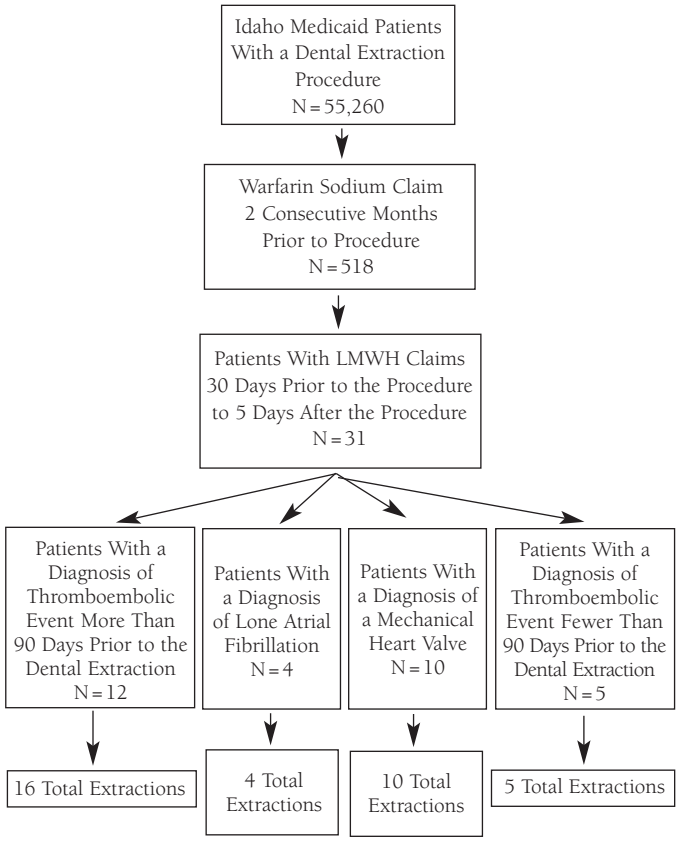
From the population identified, patients who had monthly claims for warfarin sodium in the 2 consecutive months preceding the dental procedure were identified (Figure 1). The database was queried to detect at least 1 claim for LMWH within 30 days before the procedure to 5 days after the procedure for these patients. Up to 30 days before the procedure was selected to permit inclusion of LMWH prescriptions written in anticipation of the tooth extraction, and 5 days after the procedure was selected to permit inclusion of LMWH used to stabilize INR as a result of interruption of oral anticoagulation. To help identify patients who were at risk for a thromboembolic event, we stratified individuals by likely indication for anticoagulation therapy. These indications were based on *International Classification of Diseases, Ninth Revision, Clinical Modification*

TABLE 1 *Codes Used to Extract Data, Including the Current Dental Terminology Tooth Extraction Codes, International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) Codes, and Drug Codes*[10,11]*

D7111	Extraction, coronal remnants – deciduous tooth	673.20	Obstetrical pulmonary embolism NOS – unspecified
D7140	Extraction, erupted tooth or exposed root	673.21	Obstetrical pulmonary embolism NOS – delivered
	(elevation and/or forceps removal)	673.22	Obstetrical pulmonary embolism NOS – delivered
D7210	Surgical removal of erupted tooth requiring elevation of		with postpartum complication
	mucoperiosteal flap and removal of bone and/or section of tooth	673.23	Obstetrical pulmonary embolism NOS – antepartum
D7220	Removal of impacted tooth – soft tissue	673.24	Obstetrical pulmonary embolism NOS – postpartum
D7230	Removal of impacted tooth – partially bony	V12.51	Venous thrombosis and embolism
D7240	Removal of impacted tooth – completely bony	63431	Dalteparin sodium 5,000 U/0.2 mL
D7241	Removal of impacted tooth – completely bony, with unusual	63488	Dalteparin sodium 2,500 U/0.2 mL
	surgical complications	63731	Dalteparin sodium 10,000 U/mL
D7250	Surgical removal of residual tooth roots (cutting procedure)	94116	Dalteparin sodium 7,500 U/0.3 mL
427.3	Atrial fibrillation and flutter	95075	Dalteparin sodium 10,000 U/mL
427.31	Atrial fibrillation	95776	Dalteparin sodium 25,000 U/mL
427.32	Atrial flutter	00420	Enoxaparin sodium 30 mg/0.3 mL
996.02	Mechanical complication due to heart valve prosthesis	07202	Enoxaparin sodium 30 mg/0.3 mL
996.71	Complications due to heart valve prosthesis	42071	Enoxaparin sodium 150 mg/mL
V42.2	Transplant of heart valve	42091	Enoxaparin sodium 120 mg/0.8 mL
V43.3	Replacement by other means – heart valve	62771	Enoxaparin sodium 60 mg/0.6 mL
415.1	Pulmonary embolism and infarction	62772	Enoxaparin sodium 80 mg/0.8 mL
415.11	Iatrogenic pulmonary embolism/infarction	62773	Enoxaparin sodium 100 mg/mL
415.19	Pulmonary embolism and infarction – other	70022	Enoxaparin sodium 40 mg/0.4 mL
444.21	Upper extremity embolism	96334	Enoxaparin sodium 100 mg/mL
444.22	Lower extremity embolism	15494	Fondaparinux sodium 2.5 mg/0.5 mL
453.0	Other venous embolism and thrombosis	23775	Fondaparinux sodium 5 mg/0.4 mL
453.2	Venous embolism and thrombosis of vena cava	23776	Fondaparinux sodium 7.5 mg/0.6 mL
453.3	Venous embolism and thrombosis of renal vein	23777	Fondaparinux sodium 10 mg/0.8 mL
453.40	Venous embolism and thrombosis of unspecified deep	63483	Tinzaparin sodium 20,000 U/mL
	vessels of lower extremity	25790	Warfarin sodium 10 mg
453.41	Venous embolism and thrombosis of deep vessels of the	25791	Warfarin sodium 2 mg
	proximal lower extremity	25792	Warfarin sodium 1 mg
453.42	Venous embolism and thrombosis of deep vessels of distal	25793	Warfarin sodium 5 mg
	lower extremity	25794	Warfarin sodium 2.5 mg
453.8	Venous embolism and thrombosis of other specified veins	25795	Warfarin sodium 7.5 mg
453.9	Embolism of vein – thrombosis (vein)	25796	Warfarin sodium 3 mg
639.6	Embolism	25797	Warfarin sodium 4 mg
673.0	Obstetrical pulmonary embolism	25798	Warfarin sodium 6 mg
673.2	Obstetrical blood clot embolism	25800	Warfarin sodium 5 mg

** The 5-digit numbers for drugs are First DataBank generic code numbers.*
NOS=not otherwise specified; U=unit.

FIGURE 1 Flowchart for Patient Selection



(ICD-9-CM) coding representing atrial fibrillation (codes 427.3, 427.31, 427.32), prosthetic valves (codes 996.02, 996.71, V42.2, V43.3), or past thromboembolic disease (codes 415.1, 415.11, 415.19, 444.21, 444.22, 453.0, 453.2, 453.3, 453.40, 453.41, 453.42, 453.8, 453.9, 639.6, 673.0, 673.2, 673.20, 673.21, 673.22, 673.23, 673.24, V12.51). For patients with a history of thromboembolic disease, the time of the embolic event in relation to the time of the dental procedure was further characterized (within 90 days or more than 90 days).

Each patient profile derived from electronic pharmacy and medical claims was reviewed to determine the number of tooth extractions, verify the indication for anticoagulation, and determine LMWH dose and type, patient age and gender, and associated drug costs. Patients with multiple indications for anticoagulation were categorized based on the indication with the highest risk of thromboembolism. Drug costs were those costs actually paid to pharmacies by the Idaho Medicaid program.

All Medicaid claims data were deidentified before individual patient profile review to ensure patient confidentiality. The intent and scope of this analysis were reported to the Human Subjects Committee at Idaho State University, and it was concluded that board review was unnecessary since Medicaid Drug Utilization Review (DUR) activities were performed as part of an ongoing quality assurance program and were conducted in compliance with patient privacy regulations.

Results

At the time of a tooth extraction procedure, 518 patients were anticoagulated with warfarin sodium. Of these, 31 patients (6%), for a total of 35 procedures, appeared to have had their oral anticoagulation therapy interrupted at the time of the procedure and subsequently received LMWH bridge therapy.

The average age of the 31 patients was 49.6 years, with 41.9% of them male. Enoxaparin was the primary LMWH used, prescribed in 97.1% of the tooth extractions with LMWH bridge therapy. Procedures were relatively low risk for bleeding, with an average of 1.3 teeth extracted per procedure.

The primary diagnosis for anticoagulation therapy in the patient procedures included those with a thromboembolic event more than 90 days before the dental extraction (45.7%, N = 16 extractions). Other diagnoses included mechanical valves (28.5%, N = 10), lone atrial fibrillation (11.4%, N = 4), and a thromboembolic event fewer than 90 days before the dental extraction (14.2%, N = 5). Evaluation of the LMWH dose prescribed for each procedure indicated the majority of patients received the full dose of LMWH. Patients considered at low risk for thromboembolism (e.g., patients with atrial fibrillation and those with a thromboembolic event greater than 90 days) received full-dose LMWH during 75% and 62.5% of procedures, respectively. Conversely, higher-risk patients (e.g., those with mechanical valves or patients with a history of a recent thromboembolic event) received full-dose LMWH during 40% and 20% of procedures, respectively (Figure 2).

The use of LMWH in this patient population resulted in average drug costs of $637 per procedure or $22,294 for these 31 patients, or an average drug cost of $474 per extracted tooth. Enoxaparin was used in all but 1 of the procedures, with an average 5-day supply dispensed per procedure; an average of 8 enoxaparin units were dispensed per procedure. Any costs incurred in additional drug monitoring (e.g., INR) were not determined in this analysis.

Discussion

Although the concern for bleeding complications in anticoagulated patients undergoing dental procedures is shared by patients and dentists alike, most clinical experience, as well as reports from the literature, does not support this concern.[2,3,5,12,13] A review of the literature shows that the severity of embolic complications is greater than that of bleeding complications in patients who have undergone a dental procedure. One review showed that of 774 patients on continued anticoagulation in 2,014 dental procedures, 12 (1.6%) experienced bleeding that could not be controlled by local means, and the majority

of the patients who experienced a bleed had an INR above therapeutic range.[2,14] In the relative risk analysis of continuous versus interrupted anticoagulation, 5 of 493 patients (1%) who discontinued anticoagulation for 542 dental procedures experienced a thromboembolic event, which was fatal in 4 cases.[2,14]

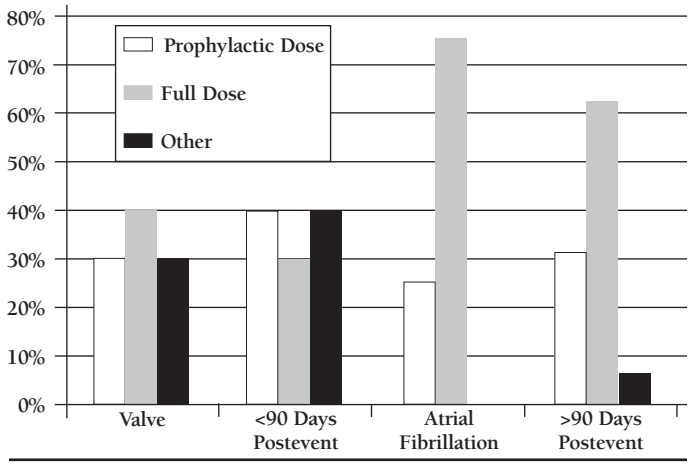
Because only patients undergoing minimally invasive procedures were included in our review and the bleeding risk associated with such procedures is low, all these patients could have likely remained on continuous warfarin therapy without risk of significant bleeding complications. Noncompliance with current guidelines in this population resulted in small but avoidable drug costs. However, we did not assess INR monitoring costs that would presumably be increased in patients stopping and restarting oral anticoagulation therapy, thereby adding to the avoidable drug costs that were estimated in the present study. Therefore, the total cost savings to be realized from continuous versus interrupted oral anticoagulation therapy in this population of Medicaid recipients are likely greater than were calculated in the current study.

This analysis also revealed improper dosing of LMWH during bridge therapy, with the majority of atrial fibrillation patients receiving full doses of LMWH. On the other hand, those at highest risk for a thromboembolic event (e.g., patients with mechanical valves) received the appropriate full LMWH dose only 30% of the time. Although dentists took precautions with the bleeding risk, this analysis shows they disregarded the more likely and more life-threatening complication of thromboembolism. In addition, the use of higher than necessary doses in patients with atrial fibrillation also contributed to excessive LMWH costs.

Controversy regarding the appropriate management of anticoagulated patients undergoing medical and dental procedures has existed for decades, with little objective data to help guide clinicians. Current recommendations state that chronically anticoagulated patients should not have their therapy interrupted for most minor dental procedures, such as tooth extraction. Additionally, bridge therapy with LMWH is likewise not indicated for such patients and is associated with unnecessary economic costs.

To our knowledge, this is the first review of its kind and suggests the potential cost savings and opportunity for quality improvement that might be realized from adherence to consensus recommendations for continuous oral anticoagulation in patients at risk of thrombosis who undergo minor dental procedures. Further education on this issue for prescribers and a better understanding of the high cost, proper dosage, and specific place in therapy for LMWH are important for optimum care management of these patients.

FIGURE 2 Dose of LMWH Received During Each Dental Procedure According to Primary Diagnosis (N = 35)



Treatment guidelines recommend full-dose LMWH therapy for patients with high thromboembolic risk, which includes patients with prosthetic valves or a recent thromboembolism (<90 days).[4,9] Prophylactic-dose LMWH is used in those patients considered to have intermediate thromboembolic risk (patients not considered low or high risk).[4,9] "Other" refers to doses of LMWH that were not associated with either full or prophylactic doses of LMWH. LMWH = low-molecular-weight heparin.

Limitations

There were some limitations associated with this review. First, laboratory values were unavailable and it was impossible to determine if an INR was obtained before the procedure and, if so, what that INR level was. Such information could have influenced the decision to use LMWH. Second, as with all administrative claims analyses, we relied on appropriate coding by providers to select study patients, which may have resulted in underestimation or misclassification of potential cases.[15,16] Third, patient weight, disease severity, and renal function were not assessed, and these factors could have influenced the decision to consider LMWH therapy as well as to select the LMWH dose.

Fourth, this review included Idaho Medicaid recipients only and, as such, may not have represented the population as a whole.[15] Fifth, there was no evaluation of the clinical outcomes for these patients who received bridge therapy with LMWH, and there was no comparison of clinical outcomes for bridge therapy with those of the patients who continued oral anticoagulation and did not receive LMWH therapy. Examining these additional data may have permitted us to determine if LMWH might have been appropriate in some cases, although given the patient and procedure-selection criteria employed in the current study, we thought this was unlikely.

Conclusion

In this review of Medicaid patients anticoagulated with warfarin and undergoing dental extractions, LMWH bridge therapy was employed in approximately 6% of procedures. Despite the overall

infrequent use of LMWH bridge therapy, such therapy was likely unnecessary in all the cases reviewed. This inappropriate drug use resulted in avoidable costs of more than $600 per extraction procedure in this Medicaid population.

What is already known about this subject

- Current guidelines from the American College of Chest Physicians (ACCP) recommend against warfarin discontinuation during both routine dental procedures (i.e. cleanings, fillings, and crowns) as well as during more invasive surgical procedures (i.e. tooth extractions and gingival surgery), based on a lack of reported bleeding complications and an increased risk for thromboembolic events.

What this study adds

- Less than 1% of Medicaid patients who had a tooth extraction received warfarin for at least 2 consecutive months prior to the tooth extraction procedure. Six percent of these patients received therapy with low-molecular-weight heparin (LMWH) coincident to the tooth extraction procedure, at an average LMWH cost of $637 per procedure.

DISCLOSURES

This research was funded under a cooperative interagency agreement between the College of Pharmacy at Idaho State University and the Idaho Department of Health and Welfare and was obtained from the Idaho Drug Utilization Review Program, Idaho State University, by authors Tracy K. Pettinger and Christopher T. Owens, who are employed by Idaho State University. They disclose no potential bias or conflict of interest relating to this article.

Pettinger served as principal author of the study. Study concept and design were contributed primarily by Pettinger, with input from Owens. Data collection and interpretation was the work of both authors. Writing of the manuscript was primarily the work of Pettinger, with input from Owens; its revision was primarily the work of Owens, with input from Pettinger.

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