

Drug therapy monitoring (TDM) of Digoxin: safety and efficacy review

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Received 30 January 2022 ♦ Accepted 6 March 2022 ♦ Published 5 April 2022

Citation: Abdi Syahputra R, Harahap U, Dalimunthe A, Nasution MP, Satria D (2022) Drug therapy monitoring (TDM) of Digoxin: safety and efficacy review. *Pharmacia* 69(2): 261–264. <https://doi.org/10.3897/pharmacia.69.e81467>

Abstract

Digoxin was developed as a novel medication for the treatment of heart failure and atrial fibrillation (AF) 200 years ago. This investigation began with a PubMed and Google Scholar search for various papers using the terms digoxin safety and efficacy, digoxin in heart failure, and digoxin in atrial fibrillation. Digoxin should be administered at a dose of 0.5–0.7 ng/mL in individuals with heart failure and reduced ejection fraction. Digoxin should be administered to decrease hospital readmissions, although SDC, creatinine, and potassium levels should be continuously maintained to limit the risk of toxicity. Digoxin may be used in conjunction with diuretics, spironolactone, ACE inhibitors, or beta-blockers. It is preferable to take digoxin on a regular basis. Digoxin should not be used in the pre-excitation syndrome because it can result in the rapid development of accessory route conductors, which can finally result in ventricular fibrillation. Due to the narrow therapeutic index of digoxin, it requires appropriate treatment and continuous monitoring.

Keywords

Digoxin, TDM, Safety, Efficacy

Introduction

Digoxin was developed as a novel medication for the treatment of heart failure and atrial fibrillation (AF) 200 years ago. The researchers supplied evidence in the form of a placebo-controlled trial and two revocation studies. In relation to the second indication, rate control in AF, the placebo-controlled study results did not provide supportive data, but indications can be used in accordance with guideline guidelines. Digoxin is typically prescribed at a daily dose of 0.25 mg to patients with atrial fibrillation and heart failure. Digoxin poisoning is more likely to develop at digoxin serum concentrations of 1.2 ng/mL or greater. Digoxin in therapeutic levels acts as a parasympathomimetic by altering the atrial myocardium, decreasing

conduction and lengthening the period of atrioventricular fracture. Oral treatment at maintenance dosages without loading doses results in steady blood concentrations in approximately 7 days in patients with normal renal function. SDC is not determined daily because it may be estimated depending on the dose utilised. Digoxin's primary method of action is to block the membrane-bound sodium-potassium ATPase subunit (sodium pump), so increasing sodium-calcium exchange and thus intracellular calcium accessible for contractile proteins (Gheorghiad 2004).

Digoxin may be used in conjunction with diuretics, spironolactone, ACE inhibitors, or beta-blockers. Digoxin should not be provided during the pre-excitation syndrome because it can result in the rapid growth of accessory route conductors, resulting in ventricular

fibrillation (Scalese et al. 2016). Due to the narrow therapeutic index of digoxin, it requires appropriate treatment and continuous monitoring. Medication, electrolytes, food, and kidney function all have an effect on digoxin serum levels. Digoxin is used for a variety of purposes, including the alleviation of heart failure symptoms and the management of ventricular rate in AF. Digoxin blood concentrations greater than 1.2 ng/ml have been associated with an increased risk of death in patients with or without heart failure and reduced systolic function. Digoxin should be used cautiously or avoided entirely in older patients, particularly those with acute coronary syndrome and renal failure. In AF patients, digoxin is suggested for usage in combination. Digoxin may be prescribed in conjunction with diuretics, spironolactone, ACE inhibitors, and beta-blockers. The target dose for patients with heart failure is 0.5–0.7 ng/ml. Digoxin therapeutic medication monitoring is required 2–3 weeks after usage since it is rapidly absorbed and increases digoxin levels in the blood; it also carries a high risk if digoxin is abruptly withdrawn. As a result, digoxin's serum drug concentration, creatinine, and potassium levels should be closely monitored to reduce the risk of toxicity. Periodic monitoring is recommended two to three weeks after taking digoxin due to its ease of absorption, which results in an increase in digoxin levels in the blood. The use of digoxin in elderly patients with atrial fibrillation, heart failure, and decreased left ventricular function makes a substantial impact in the treatment carried out, whereas monotherapy or digoxin ACC/AHA is not suggested for AF patients but is recommended in combination (Stucky, M. A, 2015). Digoxin is typically prescribed at a daily dose of 0.25 mg to patients with atrial fibrillation and heart failure. In patients with persistent atrial fibrillation, diltiazem 360 mg/day is superior to digoxin. Digoxin at therapeutic levels acts as a parasympathomimetic, slowing conduction and lengthening the period of atrioventricular fracture.

Materials and methods

This study began with a search of few related research by using PubMed and Google Scholar databases were searched using the terms digoxin safety and efficacy, digoxin in heart failure patients, and digoxin in atrial fibrillation patients. The journals that we discovered are not chronologically limited and are written in English. The journals must be concerned with the subject under discussion.

Including article criteria

1. Experimentation;
2. Digoxin has an ideal dosage;
3. Comparing digoxin to a placebo in patients with heart failure and atrial fibrillation;
4. Discussing the safety and efficacy of digoxin;
5. Digoxin outcomes.

Excluding article criteria

1. Editorial remarks;
2. Lack of full-text articles;
3. Irrelevance to the topics.

Among the several journals that discovered, there are 22 that meet the criteria. The journals that have been gathered are scientifically analysed.

Results and discussion

Digoxin mechanism of action

During the method's development, it was discovered that digoxin's primary mechanism of action is its capacity to block the membrane-bound subunit of sodium-potassium ATPase (sodium pump). This inhibition facilitates sodium-calcium exchange, hence raising the intracellular calcium concentration available to contractile proteins (Gheorghide 2004).

Drug combination

Digoxin may be prescribed in combination with diuretics, spironolactone, ACE inhibitors, and beta-blockers. It is preferable to take digoxin on a regular basis (Showkat 2000). Digoxin should not be used in the pre-excitation syndrome because it can result in the rapid development of accessory route conductors, which can finally result in ventricular fibrillation (Scalese et al. 2016).

Digoxin toxicity

A total of 19 papers evaluating digoxin and overall mortality in the clinical environment were discussed. A review of multiple journals revealed that patients receiving digoxin medication faced an increased risk of death. Zhou (2020), Renato (2018), Zeng et al. (2016), James et al. (2013), Oliver et al. (2015), and Jingmin et al. (2015) all explain this (2020). Digoxin serum concentrations more than 1.2 mg/mL increase the risk of death. Additionally, this holds true for people with or without cardiac failure (Renato 2018). While digoxin may be used in patients with heart failure and decreased systolic function, it should be used cautiously or avoided in elderly patients, particularly those with acute coronary syndrome and renal failure (Gheorghide 2004).

Digoxin toxicity

Thus, periodic monitoring is required 2–3 weeks following the administration of digoxin, as digoxin is very easily absorbed, leading in an increase in digoxin levels in the blood (Gordon 2018). This is because stopping digoxin involves extremely high risks (Malik et al. 2019). Digoxin is generally used to treat elderly AF patients who have heart failure and decreased left ventricular performance

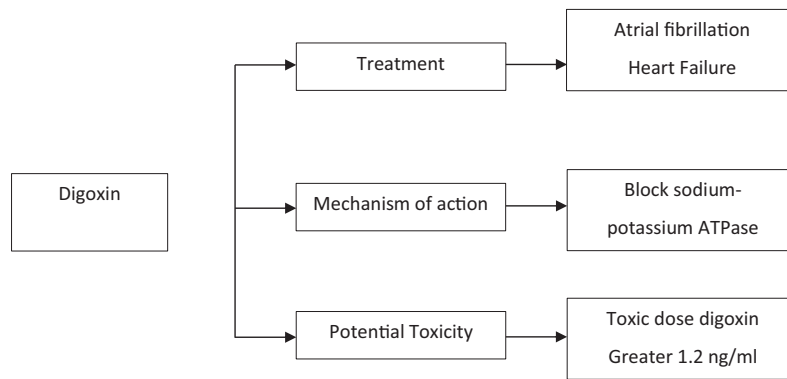


Figure 1. Digoxin summary.

(Frauchier 2016). Vamos et al. (2015) evaluated patients with atrial fibrillation and heart failure and discovered a substantial difference in the treatment they received. In patients with atrial fibrillation, monotherapy with digoxin ACC/AHA is not suggested; rather, combination therapy is recommended (Stucky 2015). Digoxin should be administered at a dose of 0.5–0.7 ng/mL in individuals with heart failure and reduced EF (Kirkwood et al. 2016). Digoxin should be administered to decrease hospital readmissions, although SDC, creatinine, and potassium levels should be continuously maintained to limit the risk of toxicity (Dimitrios et al. 2016). In patients with persistent atrial fibrillation, diltiazem 360 mg/day is superior to digoxin (Campbell 2003). For further explanation about this review can be seen in Fig. 1.

Conclusion

According to the all study that examined, all studies indicate that digoxin should be examined as a possibility, despite the fact that digoxin has no involvement in the

pharmacological recovery of atrial fibrillation and little or no evidence supporting its use in the therapy of other arrhythmias. The study population had a very high rate of heart failure and severe atrial fibrillation, as well as very poor baseline demographics and acceptance of previously prescribed medications. Antiarrhythmic medications, for example, are associated with an increased risk of death. After adjusting for confounding variables and susceptibility ratings, this meta-analysis concluded that digoxin was related with an increased risk of death in AF patients across all studies. Additionally, compared to individuals without heart failure, the risk of death was 15% for FS patients using digoxin and 18% for heart failure patients. Digoxin showed a neutral effect on mortality in heart failure patients randomly assigned to the digoxin group compared to the placebo group in the DIG investigation.

Acknowledgements

This work was supported by Universitas Sumatera Utara through DRPM 2021 and PKPI programs

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