



A Comparison of Efficacy of Acetaminophen and Diclofenac in Post-Operative Pain Management

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ABSTRACT:

Background: A vital component of patient care after surgery is post-operative pain control. Besides only making patients feel better, efficient pain management also speeds up healing, lowers the chance of complications, and improves general patient happiness and wellbeing. Providing sufficient analgesia while reducing side effects and guaranteeing patient safety is the aim of post-operative pain management. **Methods:** This is a prospective observational study conducted among the participants visiting tertiary care teaching hospital located in the southern rural part of India. For duration was 2 months. The participants were selected based in inclusion criteria and the study was completed with 70 participants of different categories. The data was collected using questionnaire and collected data was analysed and conclude the results. **Results:** A total 70 participants are were included in the study .The majority of the patients were predominantly are **Males 37 (52.85%)** and **Females 33 (41.14%)**.In this study the maximum no of subjects were between the age group of **31-40** were **22(31.42%)** followed by **51-60** were **20 (28.57%)**, **41-50** were **13 (18.57%)** and the minimum no of subjects were between in the age group of **20-30** were **9 (12.85%)** and **61-70** were **6 (8.57%)**. According to the Brief Pain Inventory score, the score ranges from **mild pain (52)** subjects, **Moderate pain (10)** and **high pain (8)**. **Conclusion:** From this comparative study we conclude that Acetaminophen to be administered for the post operative pain management than Diclofenac. According to the Brief Pain Inventory score that, score ranges from mild pain (52) subjects, Moderate pain (10) and high pain (8). Finally, the drug Acetaminophen shows greater efficacy to relive pain that Diclofenac.

Keywords: Acetaminophen, Diclofenac, Post-Operative Pain Management

INTRODUCTION:

Post-operative pain management is crucial for patient satisfaction and recovery, with tailored treatment plans enhancing patient satisfaction and overall outcomes post-surgery.

Acetaminophen, belonging to pharmacological class of NSAIDs, is the most widely used analgesic globally and is recommended as first-line therapy for pain conditions by the World Health Organization. Unlike other nonsteroidal anti-inflammatory drugs (NSAIDs) such as ibuprofen or aspirin, acetaminophen has minimal anti-inflammatory properties. It is available in various dosage forms, including syrup, tablets, injections, and suppository. It is often combined with other drugs in over 600 over-the-counter (OTC) allergy, cold, sleep, and pain relievers. One of the key advantages of acetaminophen is its relatively low incidence of gastrointestinal side effects compared to NSAIDs.

Paracetamol is used for the relief of mild to moderate pain such as headache, muscle aches, minor arthritis pain, toothache as well as pain caused by cold, flu, sprains, and dysmenorrhea .It is recommended, in particular, for acute mild to moderate pain, since the evidence for the treatment of chronic pain is insufficient.

Diclofenac is a phenylacetic acid derivative and NSAID that inhibits COX-1 and-2, the enzyme responsible for producing prostaglandins (PGs), which contribute to inflammation and pain signalling. It is commonly used as first line therapy for acute and chronic pain and inflammation. Diclofenac was designed based on phenylbutazone, mefenamic acid, and indomethacin structure.



Pharmacokinetics of acetaminophen and diclofenac:

Acetaminophen:

1. **Absorption:** Acetaminophen is rapidly absorbed from the gastrointestinal tract, with peak plasma concentrations reached within 30 to 60 minutes after ingestion. Its absorption is not significantly affected by food intake.
2. **Distribution:** Acetaminophen distributes widely throughout the body, crossing the bloodbrain barrier and placenta. It is also found in breast milk. It has a relatively short distribution half-life.
3. **Metabolism:** The majority of acetaminophen undergoes hepatic metabolism. It is primarily metabolized in the liver by glucuronidation and sulfation pathways, forming non-toxic metabolites that are excreted in the urine. However, a small percentage of acetaminophen is metabolized by the cytochrome P450 enzyme system, particularly CYP2E1, to form a toxic metabolite called N-acetyl-p-benzoquinone imine (NAPQI). Under normal circumstances, NAPQI is detoxified by glutathione. However, in cases of overdose or when glutathione levels are depleted (such as in chronic alcohol use), NAPQI can accumulate and lead to hepatotoxicity.
4. **Excretion:** Acetaminophen and its metabolites are primarily excreted in the urine. Only a small fraction (<5%) of an administered dose is excreted unchanged in the urine.

It's important to note that while acetaminophen is generally safe when used as directed, overdose can lead to liver damage and even failure due to the accumulation of toxic metabolites. Therefore, it's crucial to adhere to recommended dosages and avoid combining acetaminophen with other medications that may also contain it to prevent accidental overdose.

Diclofenac:

1. **Absorption:** Diclofenac is well-absorbed orally, with peak plasma concentrations typically reached within 1 to 2 hours after ingestion. Food can delay the rate but not the extent of absorption. Diclofenac is also available in other formulations such as topical gels, patches, and suppositories, which can affect absorption kinetics.
2. **Distribution:** Diclofenac has moderate plasma protein binding (approximately 99%) and distributes widely throughout the body, including into synovial fluid. It can cross the bloodbrain barrier and the placenta, and small amounts are found in breast milk.
3. **Metabolism:** Diclofenac undergoes extensive hepatic metabolism. The primary metabolic pathways include hydroxylation and glucuronidation, mediated by various cytochrome P450 enzymes, particularly CYP2C9. The major metabolites of diclofenac are the 4'-hydroxydiclofenac and 5-hydroxydiclofenac glucuronide conjugates. Some minor metabolic pathways involve sulfation and oxidation. Unlike acetaminophen, diclofenac does not form reactive toxic metabolites to the same extent.
4. **Excretion:** The majority of diclofenac and its metabolites are excreted in the urine, with about 65% to 70% of the administered dose eliminated this way. The remainder is excreted in the feces, primarily as glucuronide conjugates.

Factors such as age, renal function, and concomitant use of certain medications can influence the pharmacokinetics of diclofenac. For instance, individuals with impaired renal function may have prolonged elimination half-lives and increased risk of toxicity. Additionally, co-administration of drugs that inhibit or induce cytochrome P450 enzymes may affect the metabolism of diclofenac. Overall, understanding the ADME properties of diclofenac is important for optimizing its therapeutic use and minimizing adverse effects.

Pharmacodynamics of acetaminophen and diclofenac:

Acetaminophen:

1. **Analgesic (Pain-Relieving) Effects:** Acetaminophen is primarily known for its analgesic properties. It is believed to exert its effects centrally by inhibiting the synthesis of prostaglandins in the central nervous system, particularly within the hypothalamus, which is involved in the regulation of body temperature. By inhibiting prostaglandin synthesis, acetaminophen helps to reduce pain perception.
2. **Antipyretic (Fever-Reducing) Effects:** Acetaminophen also possesses antipyretic properties, which are mediated through similar mechanisms as its analgesic effects. By inhibiting prostaglandin synthesis in the hypothalamus, acetaminophen helps to reset the body's temperature set-point, leading to a reduction in fever.



3. Weak Anti-inflammatory Effects: Compared to nonsteroidal anti-inflammatory drugs (NSAIDs), such as ibuprofen or naproxen, acetaminophen has relatively weak antiinflammatory effects. While it can help to alleviate pain associated with inflammation, it does not exert significant anti-inflammatory actions at therapeutic doses. This is because acetaminophen primarily inhibits prostaglandin synthesis in the central nervous system, whereas NSAIDs inhibit prostaglandin synthesis at both central and peripheral sites.

Diclofenac:

1.Inhibition of Cyclooxygenase (COX) Enzymes: Like other NSAIDs, diclofenac exerts its primary pharmacodynamic effects by inhibiting the activity of cyclooxygenase enzymes, specifically COX-1 and COX-2. These enzymes are responsible for the conversion of arachidonic acid into prostaglandins, which play key roles in mediating inflammation, pain, and fever. By inhibiting COX enzymes, diclofenac reduces the production of prostaglandins, leading to anti-inflammatory, analgesic, and antipyretic effects.

2.Anti-inflammatory Effects: Diclofenac's inhibition of prostaglandin synthesis results in a reduction of inflammation. Prostaglandins are signalling molecules that promote vasodilation, increased vascular permeability, and recruitment of inflammatory cells to sites of injury or infection.

By blocking prostaglandin production, diclofenac helps to alleviate inflammation associated with conditions such as arthritis, tendonitis, and other inflammatory disorders.

3.Analgesic Effects: By reducing prostaglandin levels, particularly in peripheral tissues and the central nervous system, diclofenac helps to alleviate pain associated with various conditions, including musculoskeletal pain, postoperative pain, and menstrual cramps.

4.Antipyretic Effects: Diclofenac also possesses antipyretic properties, primarily due to its ability to inhibit prostaglandin synthesis in the hypothalamus, which is involved in temperature regulation. By reducing prostaglandin levels in this region of the brain, diclofenac helps to lower elevated body temperatures associated with fever.

Materials & Methods:

This is a prospective observational study conducted among the participants visiting tertiary care teaching hospital located in the southern rural part of India. The study duration was 2 months and data were collected from January 2024 to February 2024. A convenience sampling technique was followed to select the participants and enrolled for the study. At last, the study was completed with 70 participants of different categories. The participants of all age groups, both the genders, undergone surgery and administered analgesic such as Acetaminophen and Diclofenac as post-operative medication, with or without comorbidities were included in the study. The data was collected using pre-designed proforma and data was analysed accordingly.

Results :

Gender wise distribution:

S.NO	GENDER	FREQUENCY	PERCENTAGE
1	Male	37	52.85%
2	Female	33	47.14%

A total 70 participants are were included in the study .The majority of the patients were predominantly are **Males 37 (52.85%)** and **Females 33 (41.14%)**.

Age wise distribution:

S.NO	AGE GROUP	FREQUENCY	PERCENTAGE
1	20- 30	9	12.85%
2	31-40	22	31.42%
3	41-50	13	18.57%
4	51-60	20	28.57%
5	61-70	6	8.57%



In this study the maximum no of subjects were between the age group of **31-40** were **22(31.42%)** followed by **51-60** were **20 (28.57%)**, **41-50** were **13 (18.57%)** and the minimum no of subjects were between in the age group of **20-30** were **9 (12.85%)** and **61-70** were **6 (8.57%)**.

Types of Surgery :

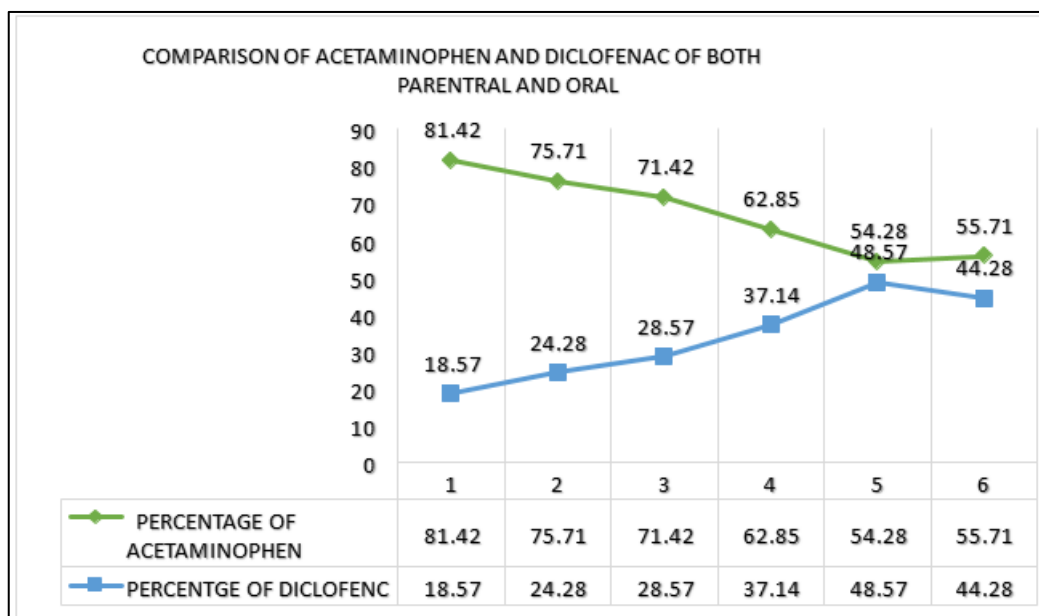
S.NO	SURGERY DONE	FREQUENCY	PERCENTAGE
1	Open Appendicectomy	6	8.57%
2	Laparoscopy	11	15.71%
3	Hernioplasty	12	17.14%
4	Anterior abdominal anatomical wall repair	5	7.14%
5	Bilateral Hernioplasty	2	2.85%
6	Pancreatomy	3	4.28%
7	Cholecystectomy	7	10%
8	Haemorrhoidectomy	5	7.14%
9	Fistulectomy	4	5.71%
10	Phimosis -Circumcision	2	2.85%
11	Hollow vicus perforation	4	5.71%
12	Modified radical Mastoidectomy	9	12.85%

In this present study shows that the most predominantly performed surgeries are Hernioplasty (17.14%) followed by Laparoscopy (15.71%), Modified radical mastoidectomy (12.85%), Cholecystectomy (10%), Open appendicectomy (8.57%), both anterior abdominal anatomical wall repair and Haemorrhoidectomy were (7.14%), both Fistulectomy and Hollow viscus perforation were (5.71%), Pancreatomy (4.28%) and least performed surgery were Bilateral hernioplasty and Phimosis Circumcision were (2.85%).

Comparing the Efficacy of Acetaminophen and Diclofenac

POD	ACETAMINOPHEN			DICLOFENAC		
	PARENTRAL	ORAL	PERCENTAGE	PARENTRAL	ORAL	PERCENTAGE
POD 0	57	0	81.42	13	0	18.57
POD 1	53	0	75.71	17	0	24.28
POD 2	50	0	71.42	20	0	28.57
POD 3	0	44	62.85	0	26	37.14
POD 4	0	38	54.28	0	34	48.57
POD 5	0	39	55.71	0	31	44.28

In this study by comparing the efficacy of Acetaminophen and Diclofenac, based on the decreasing of the pain by the pain score and also from consecutive post operative days. In **POD 0**, the majority of subjects were given parenteral **Acetaminophen 57 (81.42%)** and least parenteral **Diclofenac 13(18.57%)**, followed by **POD 1**, the majority of subjects were given parenteral Acetaminophen 53(75.71%) and parenteral diclofenac 17(24.28%), in **POD 2**, most of subjects were given parenteral **Acetaminophen 50 (71.42%)** and least parenteral **diclofenac 20 (28.57%)**, **POD 3**, most of subjects were given **oral dose of Acetaminophen 44 (62.85%)** and least of subjects are given oral **diclofenac 26(37.14%)**, **POD 4**, most of subjects were given oral **Acetaminophen 38 (54.28%)** and more over similar no of patients are given oral **diclofenac 34(48.57)**, **POD 5**, most of subjects were given oral **Acetaminophen 39 (55.71%)** and as well as oral **diclofenac 31 (44.28%)**.



According to the Brief Pain Inventory score that is performed after the 5 consecutive post operative days by administered the both Acetaminophen and Diclofenac ,Acetaminophen shows the greater extent of relieving pain that is compared with Diclofenac ,the score ranges from **mild pain (52)** subjects ,**Moderate pain (10)** and **high pain (8)**.Finally the drug Acetaminophen shows greater efficacy to relieve pain that Diclofenac. The side effects of Acetaminophen 57.14% has experienced side effects and 42.85 has no side effects.

Discussion:

Post-operative pain is the discomfort patients experience after a surgical procedure, varying in severity based on factors like surgery type, extent, individual pain thresholds, and pain management strategies. It is caused by tissue damage, manipulation, and inflammatory responses during the healing process. A total 70 participants were included in the study. The majority of the patients were predominantly are **Males 37 (52.85%)** and **Females 33 (47.14%)**. In this study the maximum no of subjects were between the age group of **31-40** were **22(31.42%)** followed by **51-60** were **20 (28.57%)**, **41-50** were **13 (18.57%)** and the minimum no of subjects were between in the age group of **20-30** were **9 (12.85%)** and **61-70** were **6 (8.57%)**.The intensity and duration can range from mild to severe, persistent pain. Effective pain management is crucial for patient comfort, recovery, and preventing complications. The above study illustrates that most of the individuals have been administered with acetaminophen that diclofenac. In this present study shows that the most predominantly performed surgeries are Hernioplasty (17.14%) followed by Laparoscopy (15.71%), Modified radical mastoidectomy (12.85%),Cholecystectomy (10%) ,Open appendicectomy (8.57%), both anterior abdominal anatomical wall repair and Haemorrhoidectomy were (7.14%) ,both Fistulectomy and Hollow viscus perforation were (5.71%) , Pancreatomy (4.28%) and least performed surgery were Bilateral hernioplasty and Phimosis-Circumcision were (2.85%).By comparing the efficacy of Acetaminophen and Diclofenac ,based on the decreasing of the pain by the pain score and also from consecutive post operative days .In **POD 0** ,the majority of subjects were given parenteral **Acetaminophen 57 (81.42%)** and least parenteral **Diclofenac 13(18.57%)**,followed by **POD 1**,the majority of subjects were given parenteral Acetaminophen 53(75.71%) and parenteral diclofenac 17(24.28%),in **POD 2** , most of subjects were given parenteral **Acetaminophen 50 (71.42%)** and least parenteral **diclofenac 20 (28.57%)** , **POD 3** , most of subjects were given **oral dose of Acetaminophen 44 (62.85%)** and least of subjects are given oral **diclofenac 26(37.14%)**, **POD 4** ,most of subjects were given oral **Acetaminophen 38 (54.28%)** and more over similar no of patients are given oral **diclofenac 34(48.57)**,**POD 5** ,most of subjects were given oral **Acetaminophen 39 (55.71%)** and as well as oral **diclofenac 31 (44.28%)**. The preference of acetaminophen may be due to reduced incidence of gastrointestinal side effects, kidney impairment, increased risk of bleeding, interaction with other medications like antihypertensives, anti-platelet agents etc., and due to tolerance and dependence. On comparison diclofenac have higher incidence of gastrointestinal side effects than acetaminophen, like GI bleeding, ulcer, nausea, vomiting, and constipation. Acetaminophen is also less likely to cause renal toxicity. NSAIDs like diclofenac can increase bleeding risk, causing concern for surgery patients or bleeding disorders, while acetaminophen is safer due to its antiplatelet effects and lack of bleeding risk. Acetaminophen is a preferred option for long-term pain management due to its lower risk of tolerance and dependence compared to other NSAIDs. Acetaminophen might also be preferred due to following interactions of diclofenac with other agents,



- **ACE Inhibitors, ARBs & Beta-Blockers:** This interaction occurs due to diclofenac inhibiting prostaglandin synthesis, leading to sodium and water retention.
- **Diuretics:** NSAIDs can decrease diuretic efficacy and increase risk of renal dysfunction.
- **Anti-diabetic medication:** There is a potential risk of kidney damage when NSAIDs like diclofenac are used concomitantly with any oral hypoglycaemic agents. According to the Brief Pain Inventory score that is performed after the 5 consecutive post operative days by administered the both Acetaminophen and Diclofenac, Acetaminophen shows the greater extent of relieving pain that is compared with Diclofenac, the score ranges from mild pain (52) subjects, Moderate pain (10) and high pain (8). Finally the drug Acetaminophen shows greater efficacy to relieve pain than Diclofenac. The side effects of Acetaminophen 57.14% has experienced side effects and 42.85 has no side effects.

Conclusion:

From this comparative study we conclude that Acetaminophen to be administered for the post operative pain management than Diclofenac. According to the Brief Pain Inventory score that, score ranges from mild pain (52) subjects, Moderate pain (10) and high pain (8). Finally the drug Acetaminophen shows greater efficacy to relieve pain than Diclofenac.

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Conflict of Interest Statement: All authors have nothing else to disclose.

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