# Dekontaminasyon yöntemlerinde güncel yaklaşımlar

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# DEKONTAMİNASYON

- Hastanın maddeden, maddenin de hastadan uzaklaştırılması

- Vücudun dışında olan toksinler yıkanır.

- Vücutta olan toksinler;
  - Midede ise boşaltılabilir
  - Barsak, kan veya dokulardaysa eliminasyonunu artırılır

# KABA DEKONTAMİNASYON

- Hasta tamamen soyulur
- Bol miktarda suyla yıkanır
- Kişisel tedbirler alınır
- Hastayla temas eden malzemeler ve eşyalar kontamine kabul edilir
- Bu işlemler hasta acil servise girmeden yapılmalıdır.

# Cilt dekontaminasyonu

**Current Pharmaceutical Biotechnology, 2010**

**Reactive Skin Decontamination Lotion (RSDL) for the Decontamination of Chemical Warfare Agent (CWA) Dermal Exposure**

**Abstract:**

Rapid decontamination of the skin is the single most important action to prevent dermal absorption of chemical contaminants in persons exposed to chemical warfare agents (CWA) and toxic industrial chemicals (TICs) as a result of accidental or intentional release. Chemicals on the skin may be removed by mechanical means through the use of dry sorbents or water. Recent interest in decontamination systems which both partition contaminants away from the skin and actively neutralize the chemical has led to the development of several reactive decontamination solutions. This article will review the recently FDA-approved Reactive Skin Decontamination Lotion (RSDL) and will summarize the toxicity and efficacy studies conducted to date. Evidence of RSDL's superior performance against vesicant and organophosphorus chemical warfare agents compared to water, bleach, and dry sorbents, suggests that RSDL may have a role in mass human exposure chemical decontamination in both the military and civilian arenas.

# Gastrointestinal dekontaminasyon

- Kusturma
- Mide yıkaması
- Aktif kömür
- Katartikler
- Tüm barsak irrigasyonu

# KUSTURMA (İpeka şurubu)

- Periferik ve santral etkili
- Doz:
  - 1-12 yaş: 15 mL
  - Erişkin:  30 mL
- Etkisi 30 dakikada başlar,
- 2 saat sürer

**Endikasyonlar**

- Aspirasyon riski yok
- Bilinç değişikliği yok
- Hemodinami stabil
- Nöbet riski yok
- Alınan madde büyük ve toksik
- Hemen
- OGS takılamıyor/ KE

# KUSTURMA (İpeka şurubu)

**Kontrendikasyonlar**

- Bilinc değişikliği
- Kostik alımlar
- Kesici madde, ilaç paketi
- Aspirasyon riski
- Nöbet riski
- < 6 ay, yaşlı, debil…

**Komplikasyonlar**

- Aspirasyon
- Boerhaave sendromu
- İnatçı kusma
- Mallory-Weiss
- Letarji
- İshal
- Diğer oral tedavileri geciktirme

Journal of Pediatric Nursing (2015) **30**, 395–401

Syrup of ipecac is a medication made of diluted extract of

Syrup of ipecac was found to have too many negative side effects such as lethargy, diarrhea, or continued vomiting (Bond, 2003). Furthermore, the medication's use could prevent some caretakers from contacting emergency services or the poison control hotline, trying to manage the episode on their own. Activated charcoal and other more specific

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healthcare

REVIEW ARTICLE

# Position paper update: ipecac syrup for gastrointestinal decontamination

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*Context*. An update of the first position paper on ipecac syrup from 1997 was published by the American Academy of Clinical Toxicology and the European Association of Poison Centres and Clinical Toxicologists in 2004. The aims of this paper are to briefly summarize the content of the 2004 Position Paper and to present any new data. *Methods*. A systematic review of the literature from the year 2003 forward. *Results*. The literature search yielded a limited number of meaningful articles, and there remains no convincing evidence from clinical studies that ipecac improves the outcome of poisoned patients. Furthermore, the availability of ipecac is rapidly diminishing. *Conclusions*. The routine administration of ipecac at the site of ingestion or in the emergency department should definitely be avoided. Ipecac may delay the administration or reduce the effectiveness of activated charcoal, oral antidotes, and whole bowel irrigation. There is not sufficient evidence to warrant any change in the previous ipecac position papers. There are, however, insufficient data to support or exclude ipecac administration soon after ingestion of some specific poisons in rare situations.

# OROGASTRİK LAVAJ

- Orogastrik tüp ilaç parçalarını toplayabilmek için uygun büyüklükte olmalı
- Erişkin: 36F-40F, çocuk: 22F-24F
- Sol lateral dekubit, yatağın başı 20 derece aşağıda
- Erişkin: 200-300 mL, Çocuk: 10 mL/kg'dır.
- Vücut sıcaklığında sıvı
- Verilen sıvıyla alınan sıvı eşit olmalı
- Gelen atık sıvı tamamen temizlenene kadar lavaja devam edilir.

# OROGASTRİK LAVAJ

**Endikasyonlar**

- Çok kısa bir süre önce hayatı tehdit eden toksin alınımı
- Aktif kömürün bağlamadığı toksinler

# OROGASTRİK LAVAJ

**Kontrendikasyonlar**

- Büyük tabletlerin yutulması
- Toksik olmayan, hayatı tehdit etmeyen alımlar
- Kostik alımlar, aspirasyon riski

**Komplikasyonlar**

- Aspirasyon, hipoksi
- Özefageal veya gastrik perforasyon

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REVIEW ARTICLE

# Position paper update: gastric lavage for gastrointestinal decontamination

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*Context.* The first update of the 1997 gastric lavage position paper was published by the American Academy of Clinical Toxicology and the European Association of Poisons Centres and Clinical Toxicologists in 2004. This second update summarizes the 2004 content and reviews new data. *Methods.* A systematic review of the literature from January 2003 to March 2011 yielded few studies directly addressing the utility of gastric lavage in the treatment of poisoned patients. *Results.* Sixty-nine new papers were reviewed. Recent publications continue to show that gastric lavage may be associated with serious complications. A few clinical studies have recently been published showing beneficial outcomes, however, all have significant methodological flaws. *Conclusions.* At present there is no evidence showing that gastric lavage should be used routinely in the management of poisonings. Further, the evidence supporting gastric lavage as a beneficial treatment in special situations is weak, as is the evidence to exclude benefit in all cases. Gastric lavage should not be performed routinely, if at all, for the treatment of poisoned patients. In the rare instances in which gastric lavage is indicated, it should only be performed by individuals with proper training and expertise.

# AKTİF KÖMÜR

- Barsak lümeni içinde toksinleri absorbe eder
- Maddelerin enterohepatik sirkulasyonunu engeller
- İlk 1 saatte faydalı
- En küçük doz aktif kömür / ilac =10/1,
- Daha yüksek doz 1 g/kg

**Kontrendikasyonlar**

- Özefageal veya gastrik perforasyon şüphesi
- Acil endoskopi ihtiyacı

# AKTİF KÖMÜR

**Aktif kömürün faydasız olduğu izole durumlar:**

-Demir

-Lityum

-Kurşun

-Hidrokarbonlar

-Alkoller

# COKLU DOZ AKTİF KÖMÜR

**Endikasyonlar**

- Yarı ömrü uzun
- Düşük hacimde dağılan toksinler
- Gastrointestinal kanalda bezoar oluşturan,
- Barsak hareketlerini yavaşlatan,
- Barsak lümenine yavaş salınan
- Enterohepatik – enteroenterik dolaşıma giren madde zehirlenmeleri (teofilin, karbamazepin, fenobarbital, kinin, dapson)

# COKLU DOZ AKTİF KÖMÜR

- ilk doz: 1 g/kg (50-100 g)
- Takip eden dozlar 0.25-0.50 g/kg'a (12.5 g) 1-3 kez, 1-4 saat arayla
- Hayatı tehdit eden toksin alan, entübe, barsak hareketleri yavaş hastalarda yararlı
- Mide distansiyonununa!
- Sıvı -elektrolit dengesizliğine!

**Kontrendike**

- Barsak motilitesini azaltan, hayatı tehdit etmeyen toksin alımları
- Mide distansiyonu artar
- Aspirasyon riski artar
- Kömür barsakta tıkanıklığa yol açabilir

European Journal of Emergency Medicine 2014

Impact of a working group on gastrointestinal decontamination in Spanish emergency departments

**Table 1** Gastrointestinal decontamination techniques performed in each group

| | *N* (%) | | | |
|---|---|---|---|---|
| Techniques | Group A (*N*=735) | Group B (*N*=170) | Group C (*N*=400) | *P* |
| Activated charcoal | 697 (94.8) | 159 (93.5) | 120 (97.5) | NS |
| Gastric lavage | 214 (29.1) | 48 (28.2) | 32 (26.0) | NS |
| Ipecac syrup | 168 (22.8) | 3 (1.7) | 0 (0) | <0.001 |

*P* value shows the level of significance of the comparison between groups A and C.

- Medicine; 2007
  Reducing absorption and increasing elimination

- Abstract

- There is no evidence that the use of activated charcoal, gastric lavage, syrup of ipecacuanha, cathartics or whole-bowel irrigation improves the clinical outcome in poisoned patients. However, activated charcoal and gastric lavage may be considered in patients who have ingested life-threatening amounts of a toxic agent up to 1 hour previously. To increase elimination, treatment with multiple-dose activated charcoal (in patients who have ingested a life-threatening amount of carbamazepine, dapsone, phenobarbital, quinine or theophylline) or urine alkalinization (in patients with moderately severe salicylate poisoning) should be employed. Haemodialysis significantly increases the elimination of ethanol, ethylene glycol, isopropanol, lithium, methanol and salicylate and should be considered in cases of severe intoxication from these agents.

Clin Toxicol (Phila). 2005

# Position paper: Single-dose activated charcoal.

American Academy of Clinical Toxicology; European Association of Poisons Centres and Clinical Toxicologists.

**Abstract**

Single-dose activated charcoal therapy involves the oral administration or instillation by nasogastric tube of an aqueous preparation of activated charcoal after the ingestion of a poison. Volunteer studies demonstrate that the effectiveness of activated charcoal decreases with time. Data using at least 50 g of activated charcoal, showed a mean reduction in absorption of 47.3%, 40.07%, 16.5% and 21.13%, when activated charcoal was administered at 30 minutes, 60 minutes, 120 minutes and 180 minutes, respectively, after dosing. There are no satisfactorily designed clinical studies assessing benefit from single-dose activated charcoal to guide the use of this therapy. Single-dose activated charcoal should not be administered routinely in the management of poisoned patients. Based on volunteer studies, the administration of activated charcoal may be considered if a patient has ingested a potentially toxic amount of a poison (which is known to be adsorbed to charcoal) up to one hour previously. Although volunteer studies demonstrate that the reduction of drug absorption decreases to values of questionable clinical importance when charcoalis administered at times greater than one hour, the potential for benefit after one hour cannot be excluded. There is no evidence that the administration of activated charcoal improves clinical outcome. Unless a patient has an intact or protected airway, the administration of charcoal is contraindicated. A review of the literature since the preparation of the 1997 Single-dose Activated Charcoal Position Statement revealed no new evidence that would require a revision of the conclusions of the Statement.

# KATARTİKLER

- Genellikle Aktif kömürle beraber verilir
- %70'lik sorbitol (1 g/kg) veya %10'luk Magnezyum sitrat (erişkinler icin 250 mL, cocuklar icin 4 mL/kg) kullanılabilir.
- Aktif kömür pasajının hızlandırırlar.

**Endikasyonlar**: genellikle aktif kömürle aynı

**Kontrendikasyonları**; ishale neden olabilecek madde alımı, 5 yaş altı cocuklar, böbrek yetmezliği, intestinal obstruksiyon ve kostik madde alımı

**Komplikasyonları;**

- bulantı
- karın ağrısı, ciddi volüm deplesyonu, sıvı- elektrolit dengesizlikleri
- böbrek fonksiyon bozukluğu olan hastalarda hipermagnezemi

- J Toxicol Clin Toxicol. 2004

- **Position paper: cathartics.**

- **Abstract**

- The administration of a cathartic alone has no role in the management of the poisoned patient and is not recommended as a method of gut decontamination. Experimental data are conflicting regarding the use of cathartics in combination with activated charcoal. No clinical studies have been published to investigate the ability of a cathartic, with or without activated charcoal, to reduce the bioavailability of drugs or to improve the outcome of poisoned patients. Based on available data, the routine use of a cathartic in combination with activated charcoal is not endorsed. If a cathartic is used, it should be limited to a single dose in order to minimize adverse effects of the cathartic. A review of the literature since the preparation of the 1997 Cathartics Position Statement revealed no new evidence that would require a revision of the conclusions of the Statement.

# TÜM BARSAK İRRİGASYONU

- Yüksek hacimlerde polietilen glikol dengeli elektrolit solusyonu içinde verilir.
- Hızlandırılmış pasajla madde barsaktan atılır
- Doz: erişkin: 1.5-2.0 L/s, 6-12 yaş çocuklarda 1 L/s, <6
  0.5 L/s hızında başlanır.
- Rektal çıkış tamamen şeffaf ve berrak olana kadar devam

# TUM BARSAK İRRİGASYONU

**Kontrendikasyonlar:**

- Varolan diare / ciddi ishale yol açabilecek madde alınımı
- Barsak seslerinin duyulmaması, barsak tıkanıklığı

**Komplikasyonlar:** şişkinlik, kramp rektal irritasyon, bulantı, kusma (metoklopramid / ondansetron)

**Endikasyonlar:**

- Aktif kömüre bağlanmayan maddelerin toksik dozları ( ağır metaller, Lİ, Fe)
- Sürekli / gecikmeli salınan madde alınımı
- Bezoar oluşturabilecek madde alınımı
- Paketli ilaç alınımı

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REVIEW ARTICLE

# Position paper update: Whole bowel irrigation for gastrointestinal decontamination of overdose patients

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The clinical relevance of this interaction is uncertain. *Conclusion.* WBI can facilitate removal of select toxicants from the gastrointestinal tract in some patients, but there is no convincing evidence from clinical studies that it improves the outcome of poisoned patients. There is no new evidence that would require a major revision of the conclusions of the 2004 position statement.

EMA Emergency Medicine Australasia

doi: 10.1111/j.1742-6723.2011.01469.x

*Emergency Medicine Australasia* (2011) **23**, 769–772

TOXICOLOGY

# Decontamination and enhanced elimination in sustained-release potassium chloride poisoning*

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## Abstract

Potassium chloride poisoning can be potentially life-threatening, particularly in massive ingestions of sustained-release preparations. Profound hyperkalaemia, developing over several hours, can lead to cardiac arrhythmias and death. This case series reports three episodes of sustained-release potassium chloride poisoning in two individuals requiring whole bowel irrigation or haemodialysis. The first two episodes, in the same patient, illustrate the contrast between the successful use of decontamination versus the need for haemodialysis. The second case, in a child, illustrates the need for tertiary level paediatric expertise in managing this type of poisoning. Whole bowel irrigation with polyethylene glycol is a resource-intensive procedure most beneficial when large numbers of radio-opaque tablets are seen in the stomach. In cases where most of the tablet matter has already been absorbed, extracorporeal methods of rapidly reducing the total body burden of potassium, such as haemodialysis, might be life-saving.

# İDRAR ALKALİNİZASYONU

**Endikasyonlar:**

- pK değeri serum pH'sından düşük
- İdrarla atılan maddelerin alınımı ( salisilat…)

**Doz:**

- 1-2 mEq/kg İV bolus / 3-4 mEq/kg/h İV infuzyon (NaHCO3)
- Aralıklı bolus / surekli infuzyon
- İdrar pH'sı 7.5-8.5 olmalı (15-30 dakikada bir kontrol) İdrar alkalinizasyonu
- Serum pH=7.50-7.55 olmalı

**Hipokalemi** düzeltilmeli

# İDRAR ALKALİNİZASYONU

**Komplikasyonlar**

- Volum yüklenmesi (kalp yetmezliği, pulmoner odem),
- pH değişiklikleri
- Hipokalemidir.

**Kontrendikasyonlar**

- Volum ve sodyum yükünü tolere edemeyen,
- Hipokalemisi olan
- Böbrek yetmezliği olan

J Toxicol Clin Toxicol. 2004

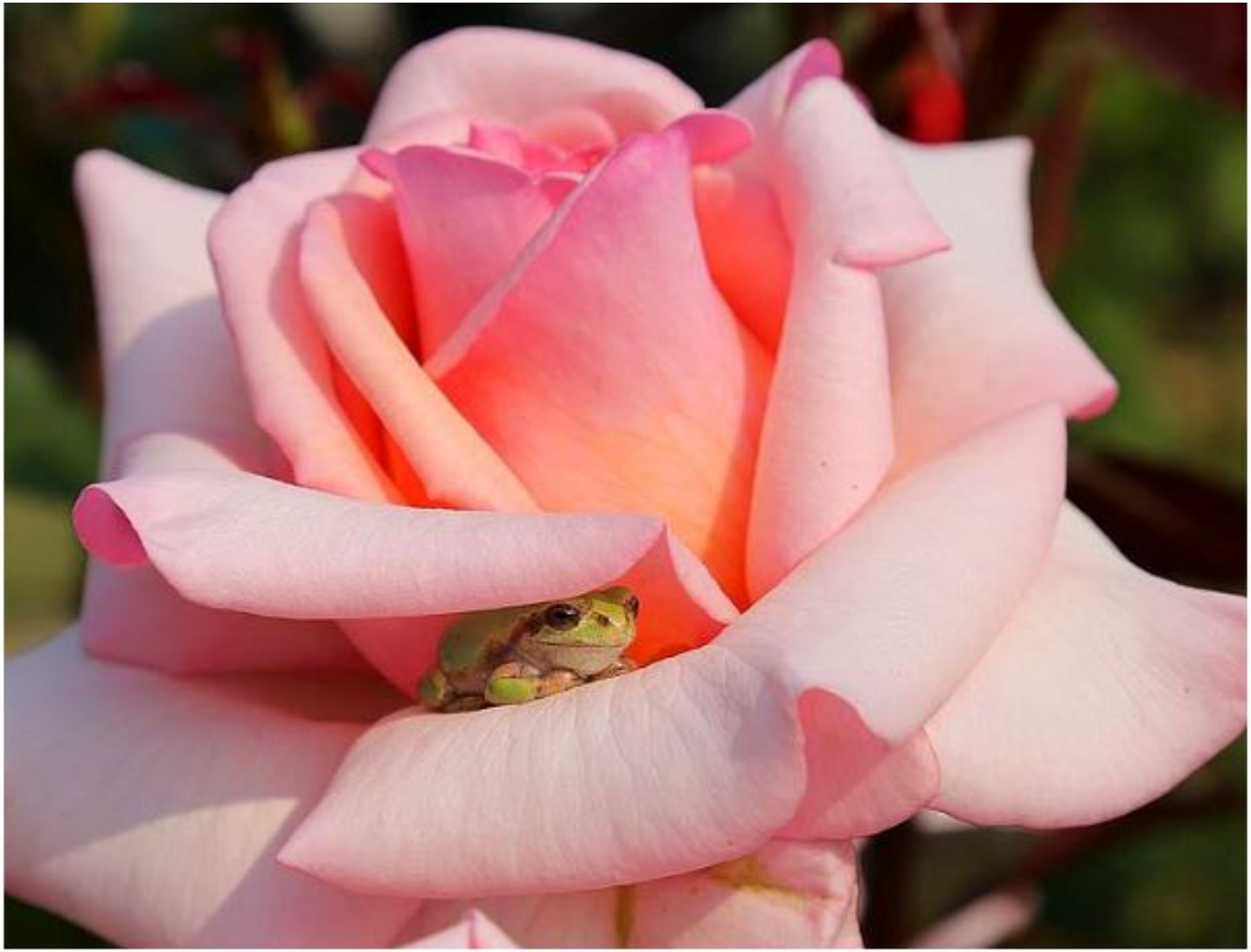
# Position Paper on urine alkalinization.


## Abstract

This Position Paper was prepared using the methodology agreed by the American Academy of Clinical Toxicology (AACT) and the European Association of Poisons Centres and Clinical Toxicologists (EAPCCT). All relevant scientific literature was identified and reviewed critically by acknowledged experts using set criteria. Well-conducted clinical and experimental studies were given precedence over anecdotal case reports and abstracts were not considered. A draft Position Paper was then produced and presented at the North American Congress of Clinical Toxicology in October 2001 and at the EAPCCT Congress in May 2002 to allow participants to comment on the draft after which a revised draft was produced. The Position Paper was subjected to detailed peer review by an international group of clinical toxicologists chosen by the AACT and the EAPCCT, and a final draft was approved by the boards of the two societies. The Position Paper includes a summary statement (Position Statement) for ease of use, which will also be published separately, as well as the detailed scientific evidence on which the conclusions of the Position Paper are based. Urine alkalinization is a treatment regimen that increases poison elimination by the administration of intravenous sodium bicarbonate to produce urine with a pH > or = 7.5. The term urine alkalinization emphasizes that urine pH manipulation rather than a diuresis is the prime objective of treatment; the terms forced alkaline diuresis and alkaline diuresis should therefore be discontinued. Urine alkalinization increases the urine elimination of chlorpropamide, 2,4-dichlorophenoxyacetic acid, diflunisal, fluoride, mecoprop, methotrexate, phenobarbital, and salicylate. Based on volunteer and clinical studies, urine alkalinization should be considered as first line treatment for patients with moderately severe salicylate poisoning who do not meet the criteria for hemodialysis. Urine alkalinization cannot be recommended as first line treatment in cases of phenobarbital poisoning as multiple-dose activated charcoal is superior. Supportive care, including the infusion of dextrose, is invariably adequate in chlorpropamide poisoning. A substantial diuresis is required in addition to urine alkalinization in the chlorophenoxy herbicides, 2,4-dichlorophenoxyacetic acid, and mecoprop, if clinically important herbicide elimination is to be achieved. Volunteer studies strongly suggest that urine alkalinization increases fluoride elimination, but this is yet to be confirmed in clinical studies. Although urine alkalinization is employed clinically in methotrexate toxicity, currently there is only one study that supports its use. Urine alkalinization enhances diflunisal excretion, but this technique is unlikely to be of value in diflunisal poisoning. In conclusion, urine alkalinization should be considered first line treatment in patients with moderately severe salicylate poisoning who do not meet the criteria for hemodialysis. Urine alkalinization and high urine flow (approximately 600 mL/h) should also be considered in patients with severe 2,4-dichlorophenoxyacetic acid and mecoprop poisoning. Administration of bicarbonate to alkalinize the urine results in alkalemia (an increase in blood pH or reduction in its hydrogen ion concentration); pH values approaching 7.70 have been recorded. Hypokalemia is the most common complication but can be corrected by giving potassium supplements. Alkalotic tetany occurs occasionally, but hypocalcemia is rare. There is no evidence to suggest that relatively short-duration alkalemia (more than a few hours) poses a risk to life in normal individuals or in those with coronary and cerebral arterial disease.

# ZORLU DİÜREZ

- Etkisi???
- İstisna: klorofenoksi herbisid (mecoprop) alınımı
- idrar alkalinizasyonu +



# Ekstrakorporeal eliminasyon

## HEMODİYALİZ

Kanda bulunan toksin ve metabolitlerinin uzaklaştırılması

**Daha az etkin:**

- Toksinin hacim dağılımı genişse (>1 L/kg)
- Molekuler ağırlığı fazlaysa (> 500 Da)
- Proteinlere bağlanma oranı yüksekse

# Ekstrakorporeal eliminasyon

**HEMODİYALİZ**

**Relatif kontrendikasyonlar**

- Hemodinamik instabilitesi olanlar
- Çok küçük çocuklar
- Damar yolu zor bulunanlar
- Şiddetli kanama diyatezi olanlar

**Komplikasyonlar**

- Sıvı - elektrolit dengesizlikleri,
- Kateter giriş yerinde infeksiyon ve kanama
- Kanama

# Ekstrakorporeal eliminasyon

## Hemoperfüzyon

- Hemodiyaliz cihazının devresine aktif kömürle doldurulmuş bir filtre takılır.
- Proteine bağlanma ve moleküler büyüklük sınırlamaları yok

Ama

- Toksinler aktif kömüre iyi bağlanmalı
- Küçük dağılım hacmine sahip olmalıdır.

(**teofilin, karbamazepin**, fenobarbital, fenitoin, etklorvinol)

Crit Care Med. 2015

# Extracorporeal Treatment for Metformin Poisoning: Systematic Review and Recommendations From the Extracorporeal Treatments in Poisoning Workgroup.


## Abstract

**BACKGROUND:**

Metformin toxicity, a challenging clinical entity, is associated with a mortality of 30%. The role of extracorporeal treatments such ashemodialysis is poorly defined at present. Here, the Extracorporeal Treatments In Poisoning workgroup, comprising international experts representing diverse professions, presents its systematic review and clinical recommendations for extracorporeal treatment in metformin poisoning.

**METHODS:**

A systematic literature search was performed, data extracted, findings summarized, and structured voting statements developed. A two-round modified Delphi method was used to achieve consensus on voting statements and RAND/UCLA Appropriateness Method to quantify disagreement. Anonymized votes and opinions were compiled and discussed. A second vote determined the final recommendations.

**RESULTS:**

One hundred seventy-five articles were identified, including 63 deaths: one observational study, 160 case reports or series, 11 studies of descriptive cohorts, and three pharmacokinetic studies in end-stage renal disease, yielding a very low quality of evidence for all recommendations. The workgroup concluded that metformin is moderately dialyzable (level of evidence C) and made the following recommendations: extracorporeal treatment is recommended in severe metformin poisoning (1D). Indications for extracorporeal treatment include lactate concentration greater than 20 mmol/L (1D), pH less than or equal to 7.0 (1D), shock (1D), failure of standard supportive measures (1D), and decreased level of consciousness (2D). Extracorporeal treatment should be continued until the lactate concentration is less than 3 mmol/L (1D) and pH greater than 7.35 (1D), at which time close monitoring is warranted to determine the need for additional courses of extracorporeal treatment. Intermittent hemodialysis is preferred initially (1D), but continuous renal replacement therapies may be considered if hemodialysis is unavailable (2D). Repeat extracorporeal treatment sessions may use hemodialysis (1D) or continuous renal replacement therapy (1D).

**CONCLUSION:**

Metformin poisoning with lactic acidosis appears to be amenable to extracorporeal treatments. Despite clinical evidence comprised mostly of case reports and suboptimal toxicokinetic data, the workgroup recommended extracorporeal removal in the case of severe metforminpoisoning.

Clin Toxicol (Phila). 2015 May;.

# Extracorporeal treatment for theophylline poisoning: Systematic review and recommendations from the EXTRIP workgroup.


## Abstract

**BACKGROUND:**

The Extracorporeal Treatments in Poisoning workgroup was created to provide evidence-based recommendations on the use of extracorporeal treatments (ECTRs) in poisoning. Here, the workgroup presents its systematic review and recommendations for theophylline.

**METHODS:**

After a systematic review of the literature, a subgroup reviewed articles, extracted data, summarized findings, and proposed structured voting statements following a pre-determined format. A two-round modified Delphi method was chosen to reach a consensus on voting statements and the RAND/UCLA Appropriateness Method was used to quantify disagreement. Anonymous votes were compiled, returned, and discussed. A second vote determined the final recommendations.

**RESULTS:**

141 articles were included: 6 in vitro studies, 4 animal studies, 101 case reports/case series, 7 descriptive cohorts, 4 observational studies, and 19 pharmacokinetic studies, yielding a low-to-very-low quality of evidence for all recommendations. Data on 143 patients were reviewed, including 10 deaths. The workgroup concluded that theophylline is dialyzable (level of evidence = A) and made the following recommendations: ECTR is recommended in severe theophylline poisoning (1C). Specific recommendations for ECTR include a theophylline concentration [theophylline] > 100 mg/L (555 µmol/L) in acute exposure (1C), the presence of seizures (1D), life-threatening dysrhythmias (1D) or shock (1D), a rising [theophylline] despite optimal therapy (1D), and clinical deterioration despite optimal care (1D). In chronic poisoning, ECTR is suggested if [theophylline] > 60 mg/L (333 µmol/L) (2D) or if the [theophylline] > 50 mg/L (278 µmol/L) and the patient is either less than 6 months of age or older than 60 years of age (2D). ECTR is also suggested if gastrointestinal decontamination cannot be administered (2D). ECTR should be continued until clinical improvement is apparent or the [theophylline] is < 15 mg/L (83 µmol/L) (1D). Following the cessation of ECTR, patients should be closely monitored. Intermittent hemodialysis is the preferred method of ECTR (1C). If intermittent hemodialysis is unavailable, hemoperfusion (1C) or continuous renal replacement therapies may be considered (3D). Exchange transfusion is an adequate alternative to hemodialysis in neonates (2D). Multi-dose activated charcoal should be continued during ECTR (1D).

## CONCLUSION:

Theophylline poisoning is amenable to ECTRs. The workgroup recommended extracorporeal removal in the case of severe theophylline poisoning.

Clin J Am Soc Nephrol. 2015 Jan

# Extracorporeal Treatment for Lithium Poisoning: Systematic Review and Recommendations from the EXTRIP Workgroup.

## Abstract

The Extracorporeal Treatments in Poisoning Workgroup was created to provide evidence-based recommendations on the use of extracorporeal treatments in poisoning. Here, the EXTRIP workgroup presents its recommendations for lithium poisoning. After a systematic literature search, clinical and toxicokinetic data were extracted and summarized following a predetermined format. The entire workgroup voted through a two-round modified Delphi method to reach a consensus on voting statements. A RAND/UCLA Appropriateness Method was used to quantify disagreement, and anonymous votes were compiled and discussed in person. A second vote was conducted to determine the final workgroup recommendations. In total, 166 articles met inclusion criteria, which were mostly case reports, yielding a very low quality of evidence for all recommendations. A total of 418 patients were reviewed, 228 of which allowed extraction of patient-level data. The workgroup concluded that lithium is dialyzable (Level of evidence=A) and made the following recommendations: Extracorporeal treatment is recommended in severe lithium poisoning (1D). Extracorporeal treatment is recommended if kidney function is impaired and the [$Li^+$] is >4.0 mEq/L, or in the presence of a decreased level of consciousness, seizures, or life-threatening dysrhythmias irrespective of the [$Li^+$] (1D). Extracorporeal treatment is suggested if the [$Li^+$] is >5.0 mEq/L, significant confusion is present, or the expected time to reduce the [$Li^+$] to <1.0 mEq/L is >36 hours (2D). Extracorporeal treatment should be continued until clinical improvement is apparent or [$Li^+$] is <1.0 mEq/L (1D). Extracorporeal treatments should be continued for a minimum of 6 hours if the [$Li^+$] is not readily measurable (1D). Hemodialysis is the preferred extracorporeal treatment (1D), but continuous RRT is an acceptable alternative (1D). The workgroup supported the use of extracorporeal treatment in severe lithium poisoning. Clinical decisions on when to use extracorporeal treatment should take into account the [$Li^+$], kidney function, pattern of lithium toxicity, patient's clinical status, and availability of extracorporeal treatments.

Zhonghua Lao Dong Wei Sheng Zhi Ye Bing Za Zhi. 2014

# Comparative study of different methods of blood purification treatment of paraquat intoxication


## Abstract

**OBJECTIVE:**

To investigate the different effect of three methods of blood purification for paraquat poisoning patients:hemoperfusion (HP), hemoperfusion combined with hemodialysis (HP + HD), hemoperfusion combined with continuous veno-venous hemofiltration (HP + CVVH).

**METHODS:**

72 cases of paraquat poisoning patients were divided into three groups after giving conventional therapy HP group, HP + HD group, HP + CVVH group. Compared the rate of decline concentrations of paraquat in blood, the liver and the kidney damage between before and after blood purification and contrast the mortality in three groups after different method of blood purification.

**RESULTS:**

The rate of decline concentrations of paraquat in blood of the HP + HD group and HP + CVVH group were both significantly greater than the HP group, but this result of HP + HD group has no significant difference compared with HP + CVVH group; Among the three groups of patients after 72 hours, the degree of dysfunction of liver of the HP + HD group and HP + CVVH group were both significantly lower than the HP group, whilely the degree of dysfunction of kidney of the HP + HD group was significantly lower than the HP group and the HP + CVVH group. The survival time of the HP + HD group and the HP + CVVH group were significant linger than the HP group, but the comparison among the three groups had no significant difference in mortality.

## CONCLUSION:

Three blood purification methods can effectively remove paraquat absorbed into the blood, and the hemoperfusion combined with hemodialysis or continuous veno-venous hemofiltration can effectively reduce the degree of damage of liver and kidney and also can prolong survival time, but did not significantly improve the survival rate of patients.

Crit Care Med. 2015 Feb

# Recommendations for the role of extracorporeal treatments in the management of acute methanol poisoning: a systematic review and consensus statement.


## Abstract

**OBJECTIVE:**

Methanol poisoning can induce death and disability. Treatment includes the administration of antidotes (ethanol or fomepizole and folic/folinic acid) and consideration of extracorporeal treatment for correction of acidemia and/or enhanced elimination. The Extracorporeal Treatments in Poisoning workgroup aimed to develop evidence-based consensus recommendations for extracorporeal treatment in methanolpoisoning.

**DESIGN AND METHODS:**

Utilizing predetermined methods, we conducted a systematic review of the literature. Two hundred seventy-two relevant publications were identified but publication and selection biases were noted. Data on clinical outcomes and dialyzability were collated and a two-round modified Delphi process was used to reach a consensus.

**RESULTS:**

Recommended indications for extracorporeal treatment: Severe methanol poisoning including any of the following being attributed to methanol: coma, seizures, new vision deficits, metabolic acidosis with blood pH ≤ 7.15, persistent metabolic acidosis despite adequate supportive measures and antidotes, serum anion gap higher than 24 mmol/L; or, serum methanol concentration 1) greater than 700 mg/L (21.8 mmol/L) in the context of fomepizole therapy, 2) greater than 600 mg/L or 18.7 mmol/L in the context of ethanol treatment, 3) greater than 500 mg/L or 15.6 mmol/L in the absence of an alcohol dehydrogenase blocker; in the absence of a methanol concentration, the osmolal/osmolar gap may be informative; or, in the context of impaired kidney function. Intermittent hemodialysis is the modality of choice and continuous modalities are acceptable alternatives. Extracorporeal treatment can be terminated when the methanol concentration is <200 mg/L or 6.2 mmol/L and a clinical improvement is observed. Extracorporeal Treatments in Poisoning inhibitors and folic/folinic acid should be continued during extracorporeal treatment. General considerations: Antidotes and extracorporeal treatment should be initiated urgently in the context of severe poisoning. The duration of extracorporeal treatment extracorporeal treatment depends on the type of extracorporeal treatment used and the methanol exposure. Indications for extracorporeal treatment are based on risk factors for poor outcomes. The relative importance of individual indications for the triaging of patients for extracorporeal treatment, in the context of an epidemic when need exceeds resources, is unknown. In the absence of severe poisoning but if the methanol concentration is elevated and there is adequate alcohol dehydrogenase blockade, extracorporeal treatment is not immediately required. Systemic anticoagulation should be avoided during extracorporeal treatment because it may increase the development or severity of intracerebral hemorrhage.

## CONCLUSION:

Extracorporeal treatment has a valuable role in the treatment of patients with methanol poisoning. A range of clinical indications for extracorporeal treatment is provided and duration of therapy can be guided through the careful monitoring of biomarkers of exposure and toxicity. In the absence of severe poisoning, the decision to use extracorporeal treatment is determined by balancing the cost and complications of extracorporeal treatment to that of fomepizole or ethanol. Given regional differences in cost and availability of fomepizole and extracorporeal treatment, these decisions must be made at a local level.

Clin Toxicol (Phila). 2014 Dec

# Extracorporeal treatment for carbamazepine poisoning: systematic review and recommendations from the EXTRIP workgroup.


## Abstract

**CONTEXT:**

The Extracorporeal Treatments in Poisoning (EXTRIP) workgroup was created to provide evidence and consensus-based recommendations on the use of extracorporeal treatments (ECTRs) in poisoning.

**OBJECTIVES:**

To perform a systematic review and provide clinical recommendations for ECTR in carbamazepine poisoning.

**METHODS:**

After a systematic literature search, the subgroup extracted the data and summarized the findings following a pre-determined format. The entire workgroup voted via a two-round modified Delphi method to reach a consensus on voting statements, using a RAND/UCLA Appropriateness Method to quantify disagreement. Anonymous votes were compiled, returned, and discussed in person. A second vote determined the final recommendations.

**RESULTS:**

Seventy-four articles met inclusion criteria. Articles included case reports, case series, descriptive cohorts, pharmacokinetic studies, and in-vitro studies; two poor-quality observational studies were identified, yielding a very low quality of evidence for all recommendations. Data on 173 patients, including 6 fatalities, were reviewed. The workgroup concluded that carbamazepine is moderately dialyzable and made the following recommendations: ECTR is suggested in severe carbamazepine poisoning (2D). ECTR is recommended if multiple seizures occur and are refractory to treatment (1D), or if life-threatening dysrhythmias occur (1D). ECTR is suggested if prolonged coma or respiratory depression requiring mechanical ventilation are present (2D) or if significant toxicity persists, particularly when carbamazepine concentrations rise or remain elevated, despite using multiple-dose activated charcoal (MDAC) and supportive measures (2D). ECTR should be continued until clinical improvement is apparent (1D) or the serum carbamazepine concentration is below 10 mg/L (42 the μ in μmol/L looks weird.) (2D). Intermittent hemodialysis is the preferred ECTR (1D), but both intermittent hemoperfusion (1D) or continuous renal replacement therapies (3D) are alternatives if hemodialysis is not available. MDAC therapy should be continued during ECTR (1D).

**CONCLUSION:**

Despite the low quality of the available clinical evidence and the high protein binding capacity of carbamazepine, the workgroup suggested extracorporeal removal in cases of severe carbamazepine poisoning.

Clin Toxicol (Phila). 2014 Sep-Oct ;

# Extracorporeal treatment for acetaminophen poisoning: recommendations from the EXTRIP workgroup.


## Abstract

**BACKGROUND:**

The Extracorporeal Treatments in Poisoning (EXTRIP) workgroup was created to provide evidence-based recommendations on the use of extracorporeal treatments (ECTR) in poisoning and the results are presented here for acetaminophen (APAP).

**METHODS:**

After a systematic review of the literature, a subgroup selected and reviewed the articles and summarized clinical and toxicokinetic data in order to propose structured voting statements following a pre-determined format. A two-round modified Delphi method was chosen to reach a consensus on voting statements, and the RAND/UCLA Appropriateness Method was used to quantify disagreement. Following discussion, a second vote determined the final recommendations.

**RESULTS:**

Twenty-four articles (1 randomized controlled trial, 1 observational study, 2 pharmacokinetic studies, and 20 case reports or case series) were identified, yielding an overall very low quality of evidence for all recommendations. Clinical data on 135 patients and toxicokinetic data on 54 patients were analyzed. Twenty-three fatalities were reviewed. The workgroup agreed that N-acetylcysteine (NAC) is the mainstay of treatment, and that ECTR is not warranted in most cases of APAP poisoning. However, given that APAP is dialyzable, the workgroup agreed that ECTR is suggested in patients with excessively large overdoses who display features of mitochondrial dysfunction. This is reflected by early development of altered mental status and severe metabolic acidosis prior to the onset of hepatic failure. Specific recommendations for ECTR include an APAP concentration over 1000 mg/L if NAC is not administered (1D), signs of mitochondrial dysfunction and an APAP concentration over 700 mg/L (4630 mmol/L) if NAC is not administered (1D) and signs of mitochondrial dysfunction and an APAP concentration over 900 mg/L (5960 mmol/L) if NAC is administered (1D). Intermittent hemodialysis (HD) is the preferred ECTR modality in APAP poisoning (1D).

## CONCLUSION:

APAP is amenable to extracorporeal removal. Due to the efficacy of NAC, ECTR is reserved for rare situations when the efficacy of NAC has not been definitively demonstrated.

Ther Apher Dial. 2009 Oct

# Early molecular adsorbents recirculating system treatment of Amanita mushroom poisoning.

## Abstract

Acute poisoning due to ingestion of hepatotoxic Amanita sp. mushrooms can result in a spectrum of symptoms, from mild gastrointestinal discomfort to life-threatening acute liver failure. With conventional treatment, Amanita phalloides mushroom poisoning carries a substantial risk of mortality and many patients require liver transplantation.
The molecular adsorbent recirculating system (MARS) is an artificial liver support system that can partly compensate for the detoxifying function of the liver by removing albumin-bound and water-soluble toxins from blood. This treatment has been used in acute liver failure to enable native liver recovery and as a bridging treatment to liver transplantation. The aim of the study is to evaluate the outcome of 10 patients with Amanita mushroom poisoning who were treated with MARS. The study was a retrospectively analyzed case series. Ten adult patients with accidental Amanita poisoning of varying severity were treated in a liver disease specialized intensive care unit from 2001 to 2007. All patients received MARS treatment and standard medical therapy for mushroom poisoning. The demographic, laboratory, and clinical data from each patient were recorded upon admission. The one-year survival and need for liver transplantation were documented. The median times from mushroom ingestion to first-aid at a local hospital and to MARS treatment were 18 h (range 14-36 h) and 48 h (range 26-78 h), respectively. All 10 patients survived longer than one year. One patient underwent a successful liver transplantation. No serious adverse side-effects were observed with the MARS treatment. In conclusion, MARS treatment seems to offer a safe and effective treatment option in Amanita mushroompoisoning.

Clin Toxicol (Phila). 2011 Nov

# Use of the molecular adsorbent recirculating system (MARS™) for the management of acute poisoning with or without liver failure.

## Abstract

**INTRODUCTION:**

There is an increasing interest in recent developments in bioartificial and non-bioartificial devices, so called extracorporeal liver assist devices, which are now used widely not only to increase drug elimination, but also to enhance the removal of endogenous substances in acute liver failure. Most of the non-bioartificial techniques are based on the principle of albumin dialysis. The objective is to remove albumin-bound substances that could play a role in the pathophysiology of acute liver failure by dialysing blood against an albumin-containing solution across a high flux permeable membrane. The most widely used device is the Molecular Adsorbent Recirculating System (MARS™).

**METHODS:**

The relevant English and French literature was identified through Medline using the terms, 'molecular adsorbent recirculating system', 'MARS', 'acute liver failure', 'acute poisoning', 'intoxication'. This search identified 139 papers of which 48 reported on a toxic cause for the use of MARS™. Of these 48 papers, 39 specified the substance (eighteen different substances were identified); two papers reported on the same group of patients. BIOARTIFICIAL AND NON-BIOARTIFICIAL SYSTEMS: Bioartificial systems based on porcine hepatocytes incorporated in the extracorporeal circuit are no longer in use due to the possibility of porcine retroviral transmission to humans. Historically, experience with such devices was limited to a few cases of paracetamol poisoning. In contrast, an abundant literature exists for the non-bioartificial systems based on albumin dialysis. The MARS™ has been used more widely than other techniques, such as the one using fractionated plasma separation and adsorption (Prometheus™). All the extracorporeal liver assist devices are able to some extent to remove biological substances (ammonia, urea, creatinine, bilirubin, bile acids, amino acids, cytokines, vasoactive agents) but the real impact on the patient's clinical course has still to be determined. Improvement in cardiovascular or neurological dysfunction has been shown both in acute liver failure and acute-on-chronic liver failure but no impact on mortality has been reported. ACUTE POISONING WITH LIVER FAILURE: Randomized controlled trials are very limited in number and patients poisoned by paracetamol or Amanita phalloides are usually included for outcome analysis in larger groups of acute liver failure patients. Initial results look promising but should be confirmed. Beyond its effect in liver failure, MARS™ could also enhance the elimination of the drug or toxin responsible for the failure, as is described with paracetamol. ACUTE POISONING WITHOUT LIVER FAILURE: Extracorporeal liver assist devices have also been used to promote elimination of drugs that are highly protein bound. Data in various case reports confirm a high elimination of phenytoin, theophylline and diltiazem. However, definite conclusions on the toxicokinetic or clinical efficacy cannot be drawn.

**CONCLUSIONS:**

Despite the lack of large multicentre randomized trials on the use of MARS™ in patients with acute liver failure, the literature shows clinical and biological benefit from this technique. In drug or toxin-induced acute liver failure, such as paracetamol or mushroom poisoning, MARS™ has been used extensively, confirming in a non-randomized fashion, the positive effect observed in the larger population of acute liver failure patients. Furthermore, as MARS™ has been shown in experimental studies to remove protein-bound substances, it is potentially a promising treatment for patients with acute poisoning from drugs that have high protein-binding capacity and are metabolized by the liver, especially, if they develop liver failure concomitantly.

# Ekstrakorporeal eliminasyon

| Xenobiotic | MW (daltons) | Water Soluble | Vd (L/Kg) | Protein Binding (%) | Endogenous Clearance (mL/min/kg) | Preferred Method |
|---|---|---|---|---|---|---|
| **Clinically Beneficial** | | | | | | |
| Bromide | 35 | Yes | 0.7 | 0 | 0.1 | HD |
| Ethylene glycol | 62 | Yes | 0.6 | 0 | 2.0 | HD |
| Diethylene glycol | 106 | Yes | 0.5 | 0 | NA | HD |
| Isopropanol | 60 | Yes | 0.6 | 0 | 1.2 | HD |
| Lithium | 7 | Yes | 0.6–1.0 | 0 | 0.4 | HD |
| Methanol | 32 | Yes | 0.6 | 0 | 0.7 | HD |
| Propylene glycol | 76 | Yes | 0.6 | 0 | 1.7 | HD |
| Salicylate | 138 | Yes | 0.2 | 50 | 0.9 | HD, HP |
| Theophylline | 180 | Yes | 0.5 | 56 | 0.7 | HP > HD |
| Valproic acid | 144 | Yes | 0.13–0.22 | 90 | 0.1 | HD, HP |

# Ekstrakorporeal eliminasyon

| Xenobiotic | MW (daltons) | Water Soluble | Vd (L/Kg) | Protein Binding (%) | Endogenous Clearance (mL/min/kg) | Preferred Method |
|---|---|---|---|---|---|---|
| **Possibly Clinically Beneficial** | | | | | | |
| Amatoxins | 373–990 | Yes | 0.3 | 0 | 2.7–6.2 | HP |
| Aminoglycosides | >500 | Yes | 0.3 | 1.5 | <10 | HD, HF |
| Atenolol | 255 | Yes | 1.0 | 2.5 | <5 | HD, HP |
| Carbamazepine | 236 | No | 1.4 | 74 | 1.3 | HP |
| Disopyramide | 340 | No | 0.6 | 1.2 | 90 | HP |
| Fluoride | 19 | Yes | 0.3 | 50 | 2.5 | HD |
| Meprobamate | 218 | Yes | 0.5–0.8 | 0–30 | Low | HP |
| Methotrexate | 454 | Yes | 0.4–0.8 | 50 | 1.5 | HF |
| Paraquat | 186 | Yes | 1.0 | 6 | 24.0 | HP |
| Phenobarbital | 232 | No | 0.5 | 24 | 0.1 | HP |
| Phenytoin | 252 | No | 0.6 | 90 | 0.3 | HP |
| Trichloroethanol | 149 | Yes | 0.6 | 0.4 | 0.7 | HD |

**TABLE 1. Reported ECTR used per decade**

**TABLE 2. List of the reported toxins most often requiring extracorporeal removal per decade**

| 1950–1969 | 1970–1979 | 1980–1989 | 1990–1999 | 2000–2009 | 2010–2014 |
|---|---|---|---|---|---|
| Barbiturate (43) | Paraquat (45) | Paraquat (77) | Ethylene glycol (66) | Methanol (97) | Metformin (75) |
| Salicylates (25) | Barbiturate (44) | Methyl xanthines (56) | Methyl xanthines (41) | Metformin (85) | Methanol (45) |
| Methanol (15) | TCAs (19) | Ethylene glycol (54) | Methanol (35) | Paraquat (83) | Ethylene glycol (45) |
| TCAs (7) | Amanita sp (19) | Methanol (49) | Lithium (35) | Ethylene glycol (80) | Lithium (28) |
| Quinine (5) | Lithium (17) | Lithium (45) | Paraquat (34) | Organophosphates (76) | Paraquat (28) |
| Isoniazid (4) | Digoxin (15) | Barbiturates (41) | Organophosphates (34) | Lithium (54) | Valproic acid (24) |
| Phenytoin (4) | Gluthetimide (14) | TCAs (30) | Amanita sp (18) | Valproic acid (45) | Dabigatran (22) |
| Gluthethimide (3) | Meprobamate (12) | Digoxin (26) | Acyclovir (18) | Acetaminophen (42) | Acetaminophen (18) |
| Ethchlorvynol (3) | Thallium (12) | Salicylates (22) | Salicylates (15) | Amanita sp (37) | Organophosphates (17) |
| Ethylene glycol (2) | Methanol (11) | Amanita sp (21) | Acetaminophen (13) | Salicylates (35) | Carbamazepine (16) |

TCAs, Tricyclic antidepressants.

# Ekstrakorporeal eliminasyon

**Plazmaferez ve kan değişimi**

Faydalı olabilir (seyir ve prognoza etkisiyle ilgili kanıt az)

- Büyük molekül ağırlıklı madde alınımı (>150 bin D)
- Proteinlere bağlı molekül zehirlenmesi

(Amanita toksinleri, tiroksin, vinkristin, digoksin)

Risk:

- Kanla bulaşan hastalık (alb, tdp)
- Hipersensitivite reaksiyonları

Kan değişimi: öz. İnfant ve yenidoğanlarda başarılı*

*Exchange transfusion in severe infant salicylism. *Vet Hum Toxicol. 2002;44:224-227.*

*Theophylline toxicity in a premature neonate-elimination kinetics of exchange transfusion. *J Toxicol ClinToxicol. 1993;31:639-644.*

# Ekstrakorporeal eliminasyon

## Periton diyalizi

- Suda çözünen, düşük molekül ağırlıklı, proteine az bağlanan, düşük dağılım hacimli toksinler için ????

  (alkol, lityum, salisilat ve teofilin)
- Tercih edilen bir yöntem değil
- Çocuklarda kan değişimi yanında kullanılabilir

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REVIEW

# Lipid emulsions in the treatment of acute poisoning: a systematic review of human and animal studies

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*Objective.* To assess the evidence regarding the efficacy and safety of intravenous fat emulsion (IFE) in the management of poisoned patients. *Methods.* We performed a systematic review of the literature with no time or language restriction. The electronic databases were searched from their inception until June 1, 2009 (Medline, EMBASE, ISI web of science, Biological abstract, LILACS, ChemIndex, Toxnet, and Proquest). We also examined the references of identified articles and the gray literature. The target interventions eligible for inclusion were administration of any IFE before, during, or after poisoning in human or animals. All types of studies were reviewed. Eligibility for inclusion and study quality scores, based on criteria by Jadad and the STROBE statement, were evaluated by independent investigators. The primary outcome was mortality. Secondary outcomes included neurologic, hemodynamic, and electrocardiographic variables, as well as adverse effects. *Results.* Of the 938 publications identified by the search strategies, 74 met the inclusion criteria. We identified 23 animal trials, 50 human, and 1 animal case reports. Overall, the quality of evidence was weak and significant heterogeneity prevented data pooling. Available data suggest some benefits of IFE in bupivacaine, verapamil, chlorpromazine, and some tricyclic antidepressants and beta-blockers toxicity. No trial assessed the safety of IFE in the treatment of acute poisoning. *Conclusion.* The evidence for the efficacy of IFE in reducing mortality and improving hemodynamic, electrocardiographic, and neurological parameters in the poisoned patients is solely based on animal studies and human case reports. The safety of IFE has not been established.

**Keywords** Fat emulsion; Intoxication; Poisoning; Intralipids; Overdose

J. Med. Toxicol. (2014)

LIPAEMIC Report: Results of Clinical Use of Intravenous Lipid Emulsion in Drug Toxicity Reported to an Online Lipid Registry

Abstract The use of intravenous lipid emulsion (ILE) as an antidote has prompted significant academic and clinical interest. Between August 2009 and August 2012, data from cases of ILE use in intoxicated patients in different hospitals on different continents were voluntarily entered into a registry based on the world wide web (www.lipidregistry.org).

Conclusions: Improvements in GCS for patients with drug-induced central nervous system toxicity, and in systolic blood pressure for shocked overdose patients, were observed following injection of lipid emulsion in this series of patients reported to the lipid registry. Few adverse effects were recorded, albeit some proved clinically significant. Clinical trials and the reporting of drug concentrations after ILE use are warranted to further define the role of ILE in clinical toxicology.

Postgrad Med. 2015 Feb

# Role of intravenous lipid emulsions in the management of calcium channel blocker and β-blocker overdose: 3 years experience of a university hospital.

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**Abstract**

Abstract Objectives: The objective of this study was to assess the efficacy of lipid emulsion as antidotal therapy in severe calcium channel blocker (CCB) and β-blocker (BB) intoxications.

**PATIENTS AND METHODS:**

This is a retrospective study in which we have summarized data of patients who were admitted to a university-based emergency department in a period of 3 years and were given intravenous lipid emulsion (ILE) to manage cardiogenic shock due to CCB and BB overdose.

**RESULTS:**

We identified 15 patients who received ILE therapy for CCB and BB toxicity. Hospitalization durations variated between 3 and 33 days (mean 7.46 ± 7.41 days). Drug exposures included CCBs (n = 8, 53.3%), CCBs and paracetamol (n = 1, 6.6%), and BBs (n = 6, 40%). ILE therapywas effective in 12 patients (80%). Three patients (20%) had resistant hypotension, one of whom progressed to pulmonary edema. Adverse effects of ILE therapy were seen in three patients (20%). Two patients underwent mechanical ventilation. Two patients developed hypoxic ischemic encephalopathy, one patient died, and 14 patients (93.3%) were discharged from hospital.

**CONCLUSION:**

There was 93.3% survival in patients receiving ILE for drug-induced cardiovascular collapse. Clinically significant adverse effects were uncommon. We suggest ILE administration for the treatment of cardiogenic shock due to CCB and BB overdose.

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Brief Report

# Intralipid emulsion treatment as an antidote in lipophilic drug intoxications☆,☆☆,★

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In our case series, ILE was used for different lipophilic drug intoxications to improve cardiovascular and neurologic symptoms. According to the results, it was found that ILE treatment is a lifesaving agent in lipophilic drug intoxications and it can be used in unconscious patients who have cardiac and/or neurologic symptoms but no history of a specific drug ingestion.

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ELSEVIER

Clinical Review

# INTRAVENOUS LIPID EMULSION IN THE EMERGENCY DEPARTMENT: A SYSTEMATIC REVIEW OF RECENT LITERATURE

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Conclusions:

In the setting of severe hemodynamic compromise by lipid-soluble xenobiotics, ILE may be considered for resuscitation by emergency physicians. As such, ILE may be stocked in emergency departments in close proximity to resuscitation rooms and areas where local nerve blocks are performed.

# Lipid emülsiyon tedavisi

- Sistemik toksisisite belirtilerin olan zehirlenmelerde A basamağından sonra önerilmiş*
- Lipid faz oluşur: lipitte çözünen toksin molekülleri akuöz plazma fazından sökülür, lipid faza çekilir ve çözünür.

Endikasyonları

- Lokal anestezik (ropivacaine, mepivacaine and prilocaine, and levobupivacaine) zehirlenmeleri
- Sistemik toksisite belirtileri (kardiyak ve nörolojik) varsa, öz. standart tedavilere cevap vermeyen kardiyak arrest

*American Society of Regional Anesthesia and Pain Medicine checklist for managing local anesthetic systemic toxicity: 2012 version. *Reg Anesth Pain Med*. Jan-Feb 2012;37(1):16-8.

# Lipid emülsiyon tedavisi

- 20% Lipid solusyonu
- 1.5 mL/kg bolus / 1dk
- 0.25 mL/kg/dk/20 dk, 30-60 dk, veya hemodinamik stabilite sağlanana kadar
- Sağlandıktan sonra en az 10 dk daha infüze edilir
- Bolus 5 dk arayla 2 kez tekrarlanabilir veya
- İnf hızı artırılabilir (max 10mL/kg/dk/30dk).

# Lipid emülsiyon tedavisi

**Komplikasyonlar**

- Hiperlipidemi
- TK ve BK çalışılamayabilir ( 3h sonra, ultrasantrifüj gerekir)
- Akut pankreatit
- ARDS

**Table 1. Xenobiotic Overdose Responses to Intravenous Lipid Emulsion Published in Case Reports and Conference Abstracts from January 2006 to February 2014 Categorized by Class of Drugs and Lipophilicity Drugs (Octanol:Water Partition Coefficient, Log P), Where Values of Log P > 2 are Considered Lipid Soluble**

| Xenobiotic | Log P* | Positive Effect† | No Apparent Effect† |
|---|---|---|---|
| Lipid soluble (Log P > 2) | | | |
| Local anesthetics | | | |
| Bupivacaine | 3.9 | 21 | |
| Ropivacaine | 2.89 | 9 | 2 |
| Lidocaine | 2.26 | 9 | 1 |
| Cocaine | 2.3 | 2 | 1 |
| Prilocaine | 2.11 | 1 | |
| Anti-depressant | | | |
| Amitriptyline | 5.04 | 9 | 2 |
| Citalopram | 3.83 | 8 | |
| Bupropion | 2.81 | 5 | 1 |
| Venlafaxine | 3.2 | 4 | |
| Doxepin | 2.4 | 4 | |
| Doxulepin | 2.8 | 3 | |
| Imipramine | 4.8 | 2 | |
| Escitalopram | 3.58‡ | 2 | |
| Desvenlafaxine | 2.8‡ | 1 | |
| Anti-psychotic | | | |
| Quetiapine | 3.54 | 7 | 2 |
| Olanzapine | 3.2 | 3 | |
| Thioridazine | 2.52 | 1 | |
| Acepromazine | 2.34 | 1 | |
| Cardiovascular | | | |
| Verapamil | 2.31 | 10 | 2 |
| Diltiazem | 2.7 | 7 | 1 |
| Propranolol | 3.09 | 5 | 2 |
| Amlodipine | 3.17 | 4 | 2 |
| Propafenone | 4.24‡ | 2 | |
| Carvedilol | 3.9 | 2 | |
| Flecainide | 3.78 | 2 | |
| Docosacain | 3.5 | 1 | 1 |
| Nebivolol | 4.04 | 1 | |
| Romifidine | 2.85‡ | 1 | |
| Detomidine | 2.48‡ | 1 | |
| Others | | | |
| Diphenhydramine | 3.4 | 5 | |
| Zolpidem | 2.25 | 2 | |
| Hydroxychloroquine | 3.87‡ | 1 | 2 |
| Bromocriptine | 8.13‡ | 1 | |
| Cyclobenzaprine | 4.81 | 1 | |
| Hydroxyzine | 4 | 1 | |
| Endosulfan | 3.58 | 1 | |
| Phenytoin | 2.47 | 1 | |
| Meperidine | 2.45 | 1 | |
| Carbamazepine | 2.3 | 1 | |
| Pentobarbital | 2.1 | 1 | |
| Methamphetamine | 2.07 | 1 | |
| Chloroquine | 4.63 | 0 | 2 |
| 2C-E | 3.43 | 1 | |
| Water soluble (Log P < 2) | | | |
| Local anesthetics | | | |
| Mepivacaine | 1.95 | 3 | 1 |
| Cardiovascular | | | |
| Metoprolol | 1.88 | 4 | 1 |
| Atenolol | 0.16 | 2 | |
| Bisoprolol | 1.87 | 1 | |
| Clonidine | 1.61 | 1 | |
| Labetalol | 1.24 | 1 | |
| Others | | | |
| Lamotrigine | 1.8 | 5 | 1 |
| Baclofen | −0.96 | 2 | |
| Amphetamine | 1.76 | 1 | |
| Phenobarbital | 1.47 | 1 | |
| Dimenhydrinate | 1.1‡ | 1 | |
| Zopiclone | −0.34 | 1 | |
| Metformin | −0.31 | 0 | 1 |
| Others | | | |
| Glyphosate/surfactant | NA | 2 | |
| Aconite | NA | 1 | |
| Amanita proxima | NA | 0 | 1 |

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# Antioxidant and Hepatoprotective Effects of Naringenin and Its β-Cyclodextrin Formulation in Mice Intoxicated with Carbon Tetrachloride: A Comparative Study

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- Tintinalli

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